

MEDICAL PROCESSING SERVICES :

TURNKEY SYSTEMS MARKETS

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ABSTRACT

This report analyzes the medical market for turnkey systems and processing services vendors, including the market itself, the market size, the users' requirements, and the overall competitive environment.

The analysis of the medical market includes market segmentation, characteristics, and driving forces. The market size and growth potential are also presented.

User requirements are analyzed by segment and size in light of opportunities for service vendors.

The report also includes profiles of the key companies in the market as well as INPUT's recommendations.

This report contains 127 pages, including 39 exhibits.

MEDICAL PROCESSING SERVICES: TURNKEY SYSTEMS MARKETS

CONTENTS

	<u>Page</u>
I INTRODUCTION.....	1
A. Objective and Scope	1
B. Key Issues	2
C. Methodology	3
D. Report Organization	4
II EXECUTIVE SUMMARY	7
A. Pressures to Reduce Health Care Costs	8
B. Hospitals Need Modern Data Processing Solutions	10
C. Turnkey Vendors Using Wrong "Sell" to Prospects	12
D. Sales, Product, and Support Challenges	14
1. Sales	14
2. Product	14
3. Support	14
E. Training, Education, and Documentation Challenges	16
1. Customer Training and Education	16
2. Documentation	16
F. Opportunities For Medical/Dental Turnkey System Vendors	18
III THE MEDICAL MARKET.....	21
A. Market Segmentation	21
1. Hospitals, Health Maintenance Organizations (HMOs), and Preferred Provider Organizations (PPOs)	21
2. Physicians, Dentists, and Other Doctors	22
3. Other Medical Organizations	26
B. Delivery Modes Serving the Medical Market	29
C. Medical Market History	30
D. Market Characteristics	32
E. Hospital Data Processing Expenditures	34
F. Market Drivers	39
1. Government's Role	39
2. The Role of Insurance Companies and Employers	40
3. The Role of Computer Product Vendors	42
4. The Role of the Health Care Data Processing Buyer	42
5. The Role of the Medical Profession	44
6. The General Public's Role	44

	<u>Page</u>
IV MARKET SIZE, GROWTH, AND SEGMENTATION	45
A. Turnkey Systems	45
1. Market Size	45
2. Market Forecast	45
3. Market Segmentation	45
B. Processing Services	49
1. Market Size	49
2. Market Forecast	49
3. Market Segmentation	49
V USER REQUIREMENTS	55
A. Requirements of Hospitals, HMOs, and PPOs	55
1. Overview	55
2. Large Medical Organization Data Processing Requirements	56
3. Small Medical Organization Data Processing Requirements	64
4. Use of Microcomputers in Health Care Organizations	65
5. Hospital Information Subsystems	73
a. Requirements for Nursing Information Systems	74
b. Requirements for Dietary Analysis Systems	75
c. Requirements for Automated Laboratory Systems	76
6. Future Directions in Medical Care	76
7. Opportunities For Hospital Information System Vendors	77
B. Requirements of Physicians, Dentists, and Other Doctors	79
1. General Requirements	79
2. Opportunities For Vendors of Medical/Dental Turnkey Systems	80
C. Other Medical Organizations	83
1. Non-Hospital Information Systems	83
2. Pharmacy Systems	84
3. Opportunities For Vendors of Pharmacy Systems	85
4. Turnkey Systems For Blood Banks	85
5. Turnkey Systems For Ambulatory Care	86
VI MEDICAL TURNKEY AND PROCESSING SERVICE VENDORS.....	89
A. Overview	89
B. Vendor Profiles	90
1. Compucare, Inc. (Subsidiary of Baxter Travenol Laboratories), Reston (VA)	90
2. Computer Sciences Corporation (CSC), Medical Systems Division, El Segundo (CA)	91
3. Electronic Data Systems (Subsidiary of General Motors Corporation), Health Services Division, Dallas (TX)	92
4. HBO & Company, Atlanta (GA)	93

	<u>Page</u>
5. McDonnell Douglas Health Systems Company (Division of McDonnell Douglas Corporation), St. Louis (MO)	94
6. MEDITECH (Medical Information Technology, Inc.), Westwood (MA)	95
7. Shared Medical Systems Corporation (SMS), Malvern (PA)	96
VII CONCLUSIONS AND RECOMMENDATIONS	99
A. Conclusions	99
1. The Medical Market	99
2. User Requirements	100
3. Vendors	101
B. Recommendations	101
1. Turnkey Systems	101
2. Processing Services	107
APPENDIX A: DEFINITIONS.....	109
APPENDIX B: SUPPLIERS	111
A. Hospital Turnkey Systems (Financial and Patient Care) Suppliers	111
B. Computer System Vendors Serving the Hospital Market	113
C. Medical Records Turnkey System Suppliers	114
D. Physician Turnkey System Suppliers	115
E. Pharmacy Turnkey System Suppliers	115
F. Radiology Turnkey System Suppliers	116
G. Laboratory Turnkey System Suppliers	117
H. Nursing Home Turnkey System Suppliers	118
I. Data Processing Services	119
J. Hospitals Selling Turnkey Systems	119
APPENDIX C: USER QUESTIONNAIRE	121
APPENDIX D: VENDOR QUESTIONNAIRE	125

MEDICAL PROCESSING SERVICES: TURNKEY SYSTEMS MARKETS

EXHIBITS

		<u>Page</u>
II	-1 Pressures to Reduce Health Care Costs	9
	-2 Hospitals Need Modern Data Processing Solutions	11
	-3 Turnkey Vendors Using Wrong "Sell" to Prospects	13
	-4 Sales, Product, and Support Challenges	15
	-5 Training, Education, and Documentation Challenges	17
	-6 Opportunities for Medical/Dental Turnkey System Vendors	19
III	-1 U.S. Hospitals, 1984	23
	-2 The Growth of HMOs, 1971-1984	24
	-3 Number of U.S. Doctors in Office and Group Practice As of December 31, 1983	25
	-4 U.S. Pharmacists As of December 1983	27
	-5 U.S. Pharmacies As of December 1983	28
	-6 U.S. Health Care Expenditures, 1972-1982	31
	-7 National Health Care, 1972-1985--Expenditures and Percent of U.S. GNP	33
	-8 Annual Budgets for Data Processing by Hospital Bed Size	35
	-9 Estimated 1984 Data Processing Budget for All 7,124 AHA Hospitals	37
	-10 Application Usage Among Hospitals Currently Using a Computer System	38
	-11 Possible U.S. Government Actions to Control Health Care Costs	41
IV	-1 Medical Market Turnkey Systems User Expenditures, 1984-1985	46
	-2 Medical Market Turnkey Systems User Expenditure Forecast, 1985-1990	47
	-3 Sales of Minicomputer-Based versus Microcomputer-Based Medical Turnkey Systems, 1985	48
	-4 Medical Market Processing Services User Expenditures, 1984-1985	50
	-5 Medical Market Processing Services User Expenditure Forecast, 1985-1990	51
	-6 Remote Computing Services versus Batch Processing in U.S. Medical Market, 1985	53

		<u>Page</u>
V	-1 Software Requirements for Large Medical Organizations	57
	-2 Radiology Subsystem Software Capabilities Checklist	58
	-3 Large Medical Turnkey System User Buying Criteria	60
	-4 Vendor Perceptions of Large Medical Turnkey System User Buying Criteria	62
	-5 Differences Between Large Medical Turnkey System User Buying Criteria and Vendor Perceptions	63
	-6 Information Requirements for Small Medical Organizations	66
	-7 Small Medical Organization Buying Criteria for Data Processing Services	67
	-8 Data Processing Service Vendor Perceptions of Small User Buying Criteria	68
	-9 Differences between Small Medical Processing Services User Buying Criteria and Vendor Perceptions	69
	-10 Small Medical Organization Buying Criteria for Turnkey Systems	70
	-11 Vendor Perceptions of Small Medical Organization Buying Criteria for Turnkey Systems	71
	-12 Differences Between Small Medical Turnkey System User Buying Criteria and Vendor Perceptions	72
	-13 Physicians' Information Processing Requirements	81
	-14 Physician and Dentist Buying Criteria for Turnkey Systems	82
	-15 U.S. Blood Bank Market, 1984	87
VII	-1 Factors for Success for Turnkey System Vendors	105

I INTRODUCTION

I INTRODUCTION

A. OBJECTIVE AND SCOPE

- This study was produced by INPUT as part of the Market Analysis and Planning Service (MAPS).
- The medical market, with user expenditures now exceeding \$400 billion, is seen by many as an excellent target for sales of data processing services and turnkey systems. However, this opportunity is not without its risks, namely:
 - The presence of large, successful vendors.
 - Vendor consolidations creating more large competitors.
 - Rapid change of procedures and policies as a result of federal government intervention.
 - Pressure from third-party organizations to reduce costs.
- The primary objective of this report is to provide vendors with specific guidance in attacking the market for medical turnkey systems and data processing services.

- This report addresses market opportunities for vendors of minicomputer- and microcomputer-based turnkey systems and data processing services offering on-line, rather than batch, processing capabilities.
- Turnkey systems analyzed are those provided by independent vendors or computer systems manufacturers costing at least \$5,000.
- This report is written primarily for:
 - Marketing executives and planners wishing to enter the medical systems or processing services markets.
 - Managers, analysts, and consultants interested in understanding more about user requirements and vendor perceptions of those requirements.
 - Investment analysts wanting to understand the dynamics of the medical systems market.
 - Hospital information systems managers who want to better understand overall user requirements as well as gain insight into vendor perceptions and future directions.
 - Administrators in large doctor group practices (physician, dentist, etc.) or clinics who wish to better understand the vendor's perspective of their market.

B. KEY ISSUES

- This report deals primarily with the market for turnkey systems serving large and small medical organizations. The secondary emphasis is the market for data processing services.

- Key issues addressed in the report include:
 - How large is the medical market? How fast is it growing?
 - What differences exist between user expectations and vendor perceptions in the purchase decision?
 - What key factors currently influence the direction of the medical market and what factors are expected to influence the medical market in the near future?
 - What are the opportunities for turnkey systems vendors and processing services firms?
 - What have the key vendors in the medical market done and in what direction are they moving?

C. METHODOLOGY

- Primary research which contributed to the analysis and conclusions in this report came from two main sources.
 - Telephone interviews in November and December 1985 with senior marketing managers at turnkey vendors and data processing service firms.
 - Telephone and personal interviews in November and December 1985 with senior executives at sites using turnkey systems, data processing service bureaus, or some combination of both.

- Vendors were asked to describe confidential information concerning their business practices. As a result, vendors participating in interviews for this report are not identified by name.
- Secondary research for this report included articles about:
 - The medical market.
 - Government's increasing role in this market.
 - Hospital data processing budgets.

D. REPORT ORGANIZATION

- This report is organized as follows:
 - Chapter II is an Executive Summary. This recap of the key points of the entire report is presented in a presentation-with-script format to facilitate the reader's internal briefing session concerning the major findings of the report.
 - Chapter III addresses the medical market. Emphasis is on the hospital, physician, and other segments of the medical market and on factors influencing the overall market.
 - Chapter IV covers the size, growth, and key segments of the medical market.
 - Chapter V discusses user requirements for processing services and turnkey systems and vendor perceptions. The discussion covers the hospital, physician, and other segments of the medical market.

- Chapter VI contains profiles of leading vendors selling to the medical market. Also included is information on company strategy, recent activities, and future direction.
- Chapter VII provides conclusions and recommendations to vendors on the medical systems market. Specific recommendations on sales approach, buyer concerns, and vendor opportunities for processing services and turnkey vendors are offered.
- Appendix A contains definitions related to this report.
- Appendix B provides a listing of suppliers of turnkey systems and processing services for the medical market.
- Appendix C provides a copy of the user questionnaire.
- Appendix D provides a copy of the vendor questionnaire.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

- This Executive Summary is designed in a presentation format in order to:
 - Help the busy reader quickly review key research findings.
 - Provide a ready-to-use executive presentation, complete with a script, to facilitate group communication.
- Key points of the report are summarized in Exhibits II-1 through II-6. On the left-hand page facing each exhibit is a script explaining the contents of the exhibit.

A. PRESSURES TO REDUCE HEALTH CARE COSTS

- The federal government is exerting the greatest pressure on hospitals to reduce costs through:
 - Establishing Diagnostic Related Groups (DRGs).
 - Shifting reimbursements from cost to DRG basis.
 - Freezing reimbursements under Medicare in 1985.
 - Reducing physical plant financing.
- Blue Cross, Blue Shield, and insurance companies:
 - Want lower costs.
 - Are negotiating reduced reimbursements for hospitals.
- Large employers want reduced health care costs because:
 - These costs are rising faster than revenues.
 - Health care benefits are expensive.
- As a result of increased longevity, Medicare expenditures have increased significantly.

PRESSURES TO REDUCE HEALTH CARE COSTS

Pressures Are Coming from:

- **Federal Government**
 - **Third Parties**
 - **Large Employers**
 - **General Public**
-

B. HOSPITALS NEED MODERN DATA PROCESSING SOLUTIONS

- DRG-based reimbursements demand up-to-the-minute information on patient treatments and related costs. On-line systems are now a requirement.
- Since government funding was reimbursement-based, hospital software needed only to tally patient expenditures. Now, hospitals must be able to calculate costs. Many hospitals have not switched their software from expenditure tallying to cost computing.
- In order to be successful, hospitals are diversifying the services they provide. These additional services can be set up to operate more efficiently with advanced data processing equipment linked to the hospital's primary system.
- Hospitals can no longer function with separate systems for financial operations, patient care, nursing management, laboratory management, medical records, etc. The same information must be re-entered in each system, resulting in greater error rates and wasted manpower. A single, integrated system would solve numerous management problems.

HOSPITALS NEED MODERN DATA PROCESSING SOLUTIONS

- **Change from Reimbursement-Centered to DRG-Based Government Funding**
 - **Many Hospitals Now Using Outdated Financial Software**
 - **Growth of Related Health Care Businesses Requires Data Processing Support**
 - **Integrated Solutions Required**
-

C. TURNKEY VENDORS USING WRONG "SELL" TO PROSPECTS

- Large hospitals' and HMOs' requirements center around software-related factors. Most turnkey vendors continue to emphasize traditional mini-computer features of "price, performance, and stable and reputable vendors."
- Processing service firms correctly perceive three of the four most important purchase decision criteria, namely:
 - Manpower savings.
 - Timely software updates.
 - Meeting government reporting requirements.

TURNKEY VENDORS USING WRONG “SELL” TO PROSPECTS

- **Many medical turnkey system vendors do not accurately perceive buyer criteria.**
- **Since they accurately perceive buyer criteria, processing service firms will maintain their penetration of the market.**

D. SALES, PRODUCT, AND SUPPORT CHALLENGES

1. SALES

- As buyers become more sophisticated, turnkey vendors must migrate from a traditional "features, benefits, and price" sell to the less threatening "consultative" sales approach.
- As previously identified, most turnkey vendors continue to misperceive user requirements. This must change.

2. PRODUCT

- Turnkey vendors must select suppliers who offer ranges of compatible processor models, disk storage devices, advanced applications software development tools, and nationwide or worldwide hardware support capability.
- Selling or licensing of source code for an additional fee would enable sophisticated customers to buy 80% of what they need at a reasonable price.

3. SUPPORT

- Turnkey vendors should investigate lower-cost third-party hardware maintenance for two reasons:
 - To maintain account control.
 - For profit potential.
- Software support should be tailored to customer requirements and unbundled to differentiate the vendor from competitors and generate additional profits.

SALES, PRODUCT, AND SUPPORT CHALLENGES

- **Learn “Consultative” Sales Techniques**
 - **Sell on User Requirements, Not Vendor Egos**
 - **Offer a Range of Compatible Hardware**
 - **Sell or License Source Code to Customers**
 - **Offer Third-Party Hardware Maintenance**
 - **Improve Software Support**
-

E. TRAINING, EDUCATION, AND DOCUMENTATION CHALLENGES

1. CUSTOMER TRAINING AND EDUCATION

- Turnkey vendors should use training classes as part of their competitive arsenal. The classes train customers' employees and enable the vendor's staff to keep in touch with customer account contacts.

2. DOCUMENTATION

- Documentation is seen by vendors as overhead and by customers as a necessity of generally poor quality. Furthermore, improved documentation offers vendors only an indirect and lengthy payback.
- On the other hand, good documentation can be a company differentiator, can help "lock in" customers, and can reduce calls for minor questions to software support.
- Do not keep talking about improving documentation--do it now.

TRAINING, EDUCATION, AND DOCUMENTATION CHALLENGES

- **Use Training Classes As a Competitive Weapon**
 - **Schedule Frequent Classes in Data Processing Topics**
 - **Documentation Reality: Vendor Overhead, Customer Necessity**
 - **Despite Indirect and Lengthy Payback, Documentation Can Be a Company Differentiator**
 - **Improve System Documentation --Now!**
-

F. OPPORTUNITIES FOR MEDICAL/DENTAL TURNKEY SYSTEM VENDORS

- Dentist offices, of which only 8% are currently computerized, offer excellent opportunities for turnkey vendors.
- Vendors should aggressively promote sales of additional software and hardware to existing customers. Add-on software includes word processing, data/voice communications, spelling checker/dictionary/thesaurus, and utilities. Hardware add-ons include additional processor memory, increased capacity disk storage, data communications, terminals, and printer upgrades.
- Education and training is an opportunity for turnkey system vendors to "lock in" customers.
- Opportunities other than the traditional acute-care hospitals exist in the medical market. Consider selling integrated systems with extensive communications capabilities to:
 - HMOs and clinics.
 - Pharmacies.
 - Blood banks.
 - Ambulatory care facilities.
 - One-day surgery centers.

OPPORTUNITIES FOR MEDICAL/DENTAL TURNKEY SYSTEM VENDORS

- **Dentist Offices**
 - **Sales of Hardware and Software Add-Ons**
 - **Providing Data Processing Education and Training for Customers**
 - **Developing and Selling Systems to Other Medical Organizations**
-

III THE MEDICAL MARKET

III THE MEDICAL MARKET

A. MARKET SEGMENTATION

- The medical market encompasses a number of submarkets, each with unique characteristics, distinct trends, and specialized data processing requirements.
- INPUT divides the medical market into three segments: hospitals, health maintenance organizations (HMOs), and preferred provider organizations (PPOs); physicians, dentists, and other doctors; and other medical organizations.
- I. HOSPITALS, HEALTH MAINTENANCE ORGANIZATIONS (HMOs), AND PREFERRED PROVIDER ORGANIZATIONS (PPOs)
 - Hospitals include:
 - Acute-care hospitals.
 - Urban medical centers.
 - Military and Veterans Administration hospitals.
 - Hospitals for tuberculosis and other respiratory diseases.

- Chronic disease hospitals.
 - Institutions for the mentally retarded.
 - Institutions for alcoholics.
 - Institutions for those with chemical dependencies.
- Exhibit III-1 shows the number of each major category of hospital in 1984.
 - HMOs provide comprehensive medical coverage to members in return for a fixed periodic payment. The rapid growth of HMOs between 1971 and 1984 is shown in Exhibit III-2.
 - PPOs provide discount-rate health care to plan members in exchange for prompt payment and a guaranteed patient base. PPOs are favored by employers with large local facilities who thus bypass third-party payors.

2. PHYSICIANS, DENTISTS, AND OTHER DOCTORS

- This category includes physicians and dentists in solo, small group, or clinical practices. It excludes physicians and dentists in research or those maintaining a practice at a university medical center.
- "Other Doctors" includes chiropractors, optometrists, osteopaths, and podiatrists. Details of the number of practicing doctors in each category are provided in Exhibit III-3.
- Although veterinarians do not provide medical services to humans, they are included as a target market primarily for turnkey systems.

EXHIBIT III-1

U.S. HOSPITALS, 1984

TYPE	NUMBER
Community	5,800
Other*	1,100
Total	6,900

*"Other" includes:

- Non-community Hospitals
- Tuberculosis Hospitals
- Chronic Disease Hospitals
- Institutions for:
 - Mentally Retarded
 - Alcoholics
 - Those with Chemical Dependencies

"Other" excludes:

- Military Hospitals
- Veterans Administration Hospitals
- U.S. Public Health Service Hospitals

Source: Federation of American Hospitals.

EXHIBIT III-2

THE GROWTH OF HMOs, 1971-1984

YEAR	NUMBER OF PREPAID PLANS	TOTAL ENROLLMENT (Millions)
December 1971	39	3.1
June 1976	175	6.0
June 1978	198	7.3
June 1979	215	8.2
June 1981	243	10.2
December 1982	269	11.6
April 1984	326	13.6

Source: U.S. Department of Health and Human Services.

EXHIBIT III-3

NUMBER OF U.S. DOCTORS IN OFFICE AND GROUP PRACTICE AS OF DECEMBER 31, 1983

CATEGORY	TOTAL 12/31/83*	IN OFFICE PRACTICE	IN PARTNERSHIP/ GROUP PRACTICE**
Physicians	519,546	309,891	140,392
Dentists	120,000	92,000	25,000
Chiropractors	Unknown	25,000	3,000
Optometrists	Unknown	23,500	7,000
Podiatrists	10,900	9,200	1,700
Veterinarians	Unknown	38,154	9,100
Total (individual or group practice)	-	497,745	186,192

*Includes those retired, engaged in research or administration, or working for insurance and related firms.

**Total number of doctors in group practices, not the number of group practices. INPUT estimates the number of doctors per partnership or group practice as follows:

- 3.5 Physicians
- 2.2 Dentists
- 2.1 Chiropractors
- 2.3 Optometrists
- 2.1 Podiatrists
- 2.6 Veterinarians

Source: U.S. Medical Associations.

3. OTHER MEDICAL ORGANIZATIONS

- Other medical organizations include:
 - Community, chain store, and hospital pharmacies.
 - Nursing homes.
 - Home health agencies.
 - Third-party health plans.
 - Freestanding emergency clinics.
 - One-day surgery centers.
 - Physical therapy centers.
 - For-profit blood banks.
 - Occupational therapists.
- The number of licensed pharmacists and the number of pharmacies in the U.S., as shown in Exhibits III-4 and III-5, represent a sizeable target market for computer services and systems.
- As of 1984, there were 12,000 nursing homes in the U.S.
- Occupational therapists, responsible for retraining persons to use fine motor skills and establishing personal independent living skills, number 3,600. More than 80% work in large health care institutions; the remainder are self-employed.

EXHIBIT III-4

U.S. PHARMACISTS
AS OF DECEMBER 1983

Total Number of Licensed Pharmacists	170,553
Less: Retired, Inactive, and Pharmacists in Research and Private Industry	11,500
Number of Active Pharmacists	<u>159,053</u>

Source: American Pharmaceutical Association.

EXHIBIT III-5

U.S. PHARMACIES
AS OF DECEMBER 1983

TYPE OF PHARMACY	NUMBER
Community	47,882
Chains and Hospital-Based	14,372
Total	62,254

Source: American Pharmaceutical Association.

B. DELIVERY MODES SERVING THE MEDICAL MARKET

- INPUT divides the computer services market into four primary segments:
 - Processing services.
 - Facilities management.
 - Remote computing services.
 - Batch processing services.
 - Professional services.
 - Facilities management.
 - System design.
 - Custom/contract programming.
 - Consulting.
 - Education and training.
 - Software products.
 - Systems software.
 - Applications software.
 - Turnkey systems.

- The delivery modes serving the medical market are:
 - Turnkey systems.
 - Facilities management.
 - Remote computing services.
 - Batch processing services.
 - Mainframe/minicomputer applications software vendors.
 - Microcomputer applications software vendors.
- This report emphasizes turnkey systems, remote computing services, and batch processing services.
- INPUT's definitions of each delivery mode are included in Appendix A.

C. MEDICAL MARKET HISTORY

- Between 1972 and 1982 the medical market grew significantly. Overall, expenditures increased at a 13.1% compound annual growth rate. According to Exhibit III-6, expenditures for health services and supplies represented the fastest-growing component of U.S. health care costs.
- In the early 1970s, the medical information market was served primarily by batch-oriented remote processing services.
- The introduction and widespread use of minicomputers enabled these services to provide interactive remote processing in the mid to late 1970s.

EXHIBIT III-6

U.S. HEALTH CARE EXPENDITURES

1972-1982

TYPE OF EXPENDITURE	(\$ Billions)				CAGR 1972-1982 (Percent)
	1972	1975	1978	1982	
Health Services and Supplies	\$87.4	\$124.3	\$181.2	\$308.1	13.4%
Research and Construction of Medical Facilities	\$ 6.6	\$ 8.4	\$ 9.8	\$ 14.1	7.9%
Annual Total	\$94.6	\$132.7	\$191.0	\$322.2	13.1%

Source: U.S. Industrial Outlook 1985.

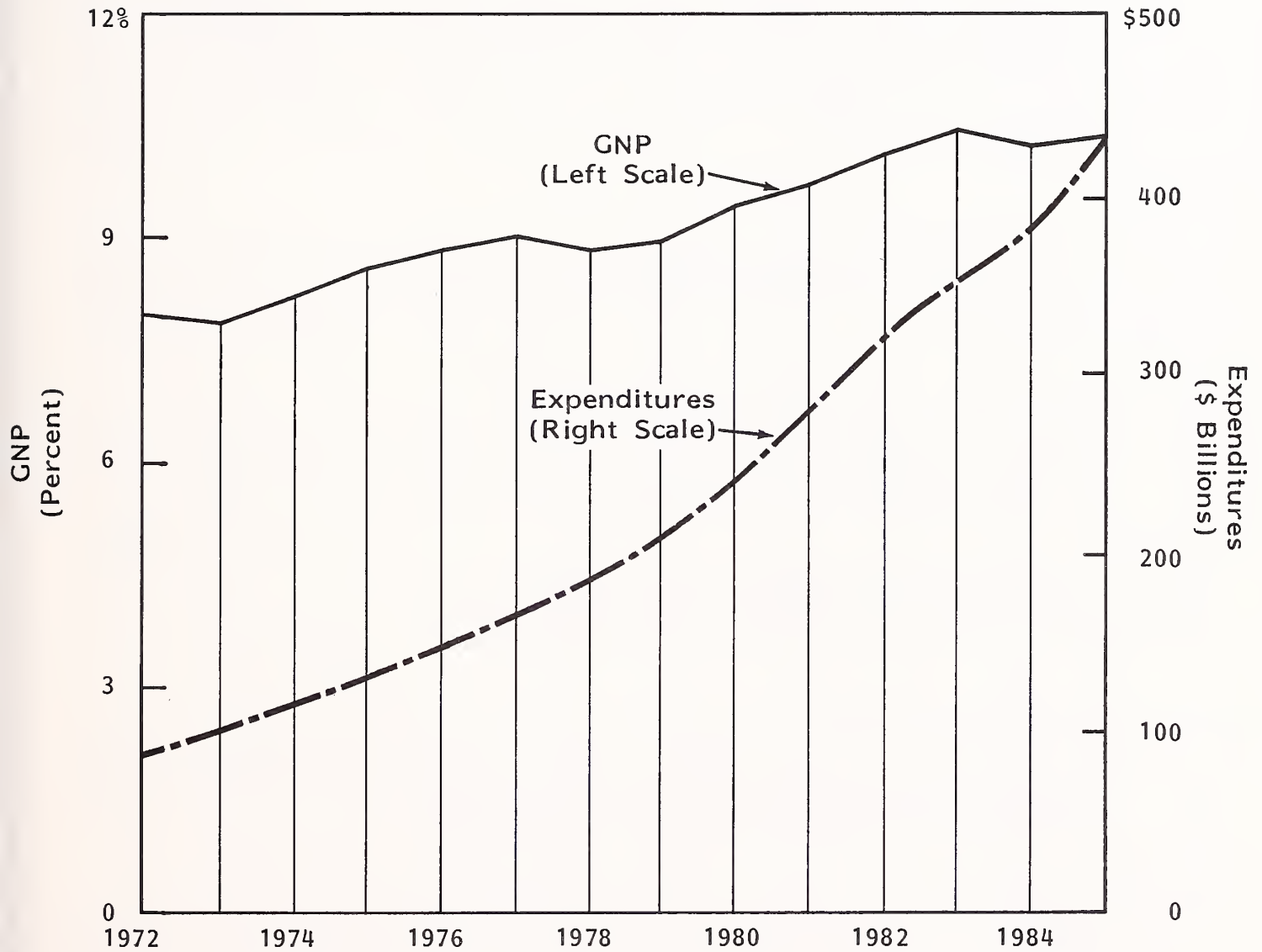
- Minicomputer-based turnkey systems for health care information were first sold in the late 1970s and early 1980s.
- Following the trend toward less expensive computer hardware, micro-computer-based turnkey systems for health care applications are now actively marketed.

D. MARKET CHARACTERISTICS

- Health care's share of the total U.S. Gross National Product (GNP) has increased from 8.5% in 1972 to 10.5% in 1984. The largest component, hospital care, represented 40.8% of total 1984 health care costs. Exhibit III-7 graphically shows the growth in health care expenditures in the U.S.
- Health care expenditures in the United States rose to an estimated \$383.4 billion in 1984, an 8.1% increase over 1983. On a per capita basis, 1984 expenditures amounted to about \$1,565.
- Turnkey system vendors should be aware of the growth in lower cost non-acute care (specialized) medical facilities, which include kidney dialysis centers and one-day surgery centers. These organizations may be part of a large hospital complex or may be operated as standalone centers.
- Hospitals are unique service entities. Two hospitals, each with 250 beds, can be very different. One may offer departments for maternity, pediatrics, and open heart surgery, the other may not. Not all hospitals offer emergency room services. The bottom line--hospitals' data processing needs are as diverse as the services provided.

EXHIBIT III-7

NATIONAL HEALTH CARE, 1972-1985
EXPENDITURES AND PERCENT OF U.S. GNP



Source: Health Care Financing Administration.

- A hospital's (or HMO's or PPO's) primary function is to serve its staff physicians. Physicians order the services for their patients that the hospitals, HMOs, or PPOs provide. Turnkey systems or processing services must process information needed by physicians or department managers and administrators.
- Due to technological advances making hospital-based tests non-invasive (to the human body) and the growing number of lawsuits against physicians, doctors are ordering more tests for patients to help in their diagnoses. The results of such tests must be integrated into modern hospital information systems.
- INPUT estimates 55% of small and medium hospitals use remote computing services (RCS). Approximately 15% employ third-party facilities management (FM) firms.
- About 25% of medium and 35% of large hospitals either use in-house computer systems running third-party software packages or buy turnkey systems.

E. HOSPITAL DATA PROCESSING EXPENDITURES

- In 1984, the data processing (DP) budget for all 7,124 American Hospital Association hospitals was estimated at \$3.1 billion. The DP budget includes expenditures for hardware, software, and personnel.
- Annual budgets for data processing by hospital bed size are shown in Exhibit III-8.
 - Hospitals with more than 500 beds, comprising 8.1% of all U.S. hospitals, accounted for 26.6% of 1984 total hospital DP spending.

EXHIBIT III-8

ANNUAL BUDGETS FOR DATA PROCESSING BY HOSPITAL BED SIZE

Frequency Percent Row Percent Column Percent	Hospital Bed Size						Total
	<100 Beds	101-200 Beds	201-300 Beds	301-400 Beds	401-500 Beds	>500 Beds	
DP Annual Budgets	360	136	29	8	6	27	
	29.9	11.3	2.4	0.7	0.5	2.2	566
	63.6	24.0	5.1	1.4	1.1	4.8	47.0
	91.6	48.4	15.4	6.6	7.4	19.6	
	26	110	70	22	8	15	
	2.2	9.1	5.8	1.8	.7	1.2	251
	10.4	43.8	27.9	8.8	3.2	6.0	20.9
	6.6	39.2	37.2	18.0	9.9	10.9	
	2	26	36	28	5	5	
	0.2	2.2	3.0	2.3	0.4	0.4	102
	2.0	25.5	35.3	27.4	4.9	4.9	8.5
	0.5	9.2	19.2	22.9	6.2	3.6	
	2	4	28	27	11	8	
	0.2	0.3	2.3	2.2	0.9	0.7	80
	2.5	5.0	35.0	33.8	13.8	10.0	6.6
	0.5	1.4	14.9	22.1	13.6	5.8	
	1	0	19	25	24	22	
	0.1	0.0	1.6	2.1	2.0	1.8	91
	1.1	0.0	20.9	27.5	26.4	24.2	7.6
	0.2	0.0	10.1	20.5	29.6	15.9	
	0	2	2	8	15	20	
	0.0	0.2	0.2	0.7	1.2	1.6	47
	0.0	4.3	4.3	17.0	31.9	42.5	3.9
	0.0	0.7	1.1	6.6	18.5	14.5	
	1	1	1	1	2	11	
	0.1	0.1	0.1	0.1	0.2	9.1	17
	5.9	5.9	5.9	5.9	11.8	64.7	1.4
	0.2	0.4	0.5	0.8	2.5	8.0	
	1	1	2	3	6	9	
	0.1	0.1	0.2	0.2	0.5	0.8	22
	4.6	4.6	9.1	13.6	27.3	40.9	1.8
	0.2	0.4	1.1	2.5	7.4	6.5	
	0	1	1	0	4	21	
	0.0	0.1	0.1	0.0	0.3	1.8	27
	0.0	3.7	3.7	0.0	14.8	77.8	2.2
	0.0	0.4	0.5	0.0	4.9	15.2	
	Total	393	281	188	122	81	1,203
		32.7	23.4	15.6	10.1	6.7	100.0

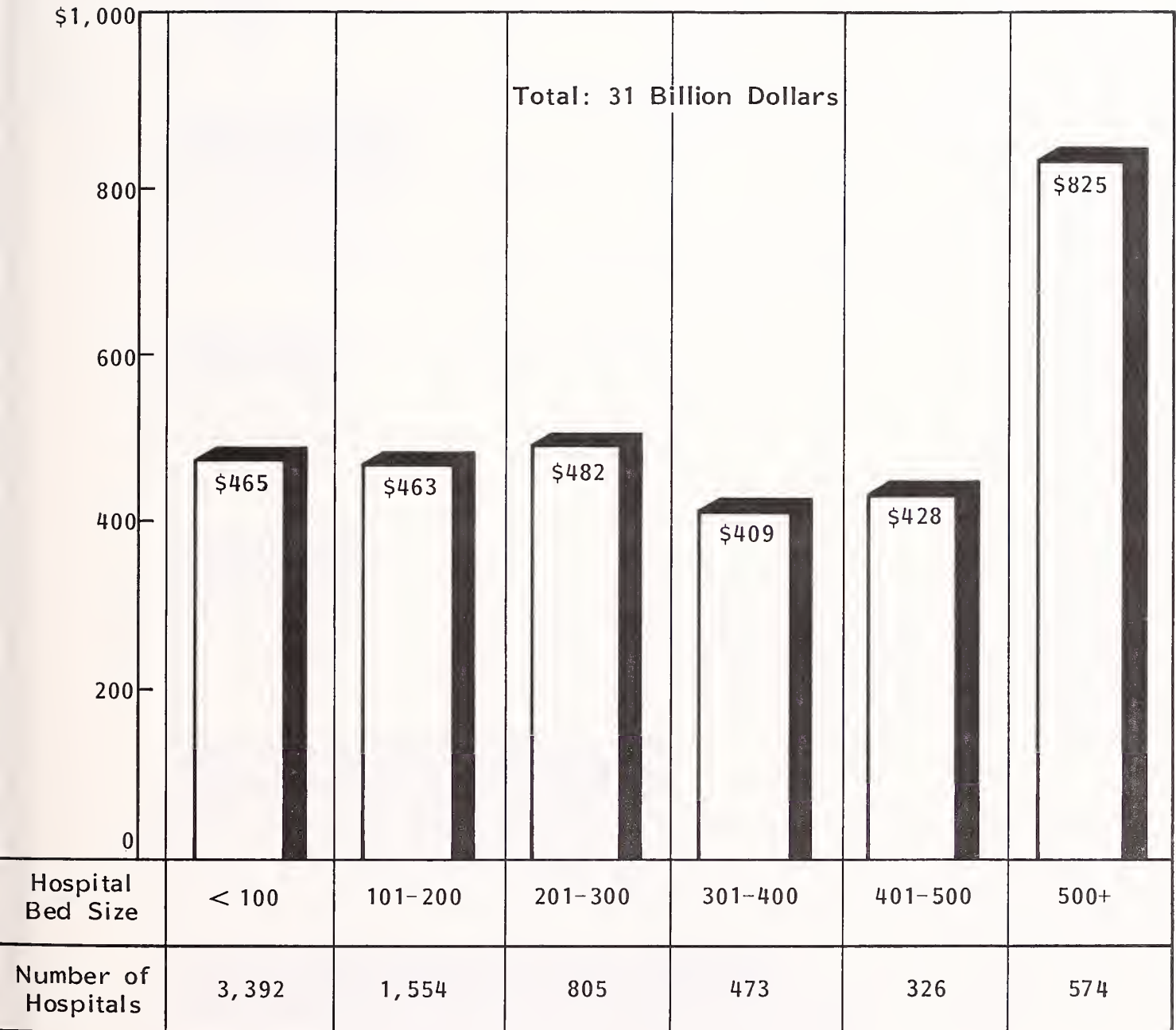
Explanation: For data in the upper left-hand box, there are 360 hospitals, 100 beds or less, that responded to the survey. These hospitals have budgeted less than \$200,000 each for data processing. This group represents 29.9% of the total survey group, 63.6% of the less than \$200,000 budget group (row total), and 91.6% of 100 beds or less hospitals (column totals).

Source: 1985 National Survey on Hospital Data Processing, Medical Systems Division, University of Florida.

- Hospitals with between 200 and 500 beds, representing 22.5% of total U.S. hospitals, spent 42.5% of total 1984 hospital DP dollars.
- Hospitals with less than 200 beds, comprising about 75% of all U.S. hospitals, accounted for 29.9% of 1984 total hospital DP spending.
- Only hospitals with annual DP budgets exceeding \$1 million have shown consistent growth in DP budget expenditures according to Exhibit III-9. Aggregate expenditures in hospitals with annual budgets of less than \$1 million have remained flat or decreased between 1982 and 1984 and were expected to do likewise in 1985.
- Tremendous opportunities exist for vendors serving the hospital data processing market (see Exhibit III-10). According to a recent survey of hospitals using data processing equipment:
 - Less than 30% reported installation of modules for order entry, laboratory, pharmacy, and radiology systems.
 - Nearly 25% of current users were shopping for various system components.
 - Approximately 20% of user respondents reported that they intend to replace their current systems.
 - Eleven percent of user respondents were considering a move toward system replacement.

EXHIBIT III-9

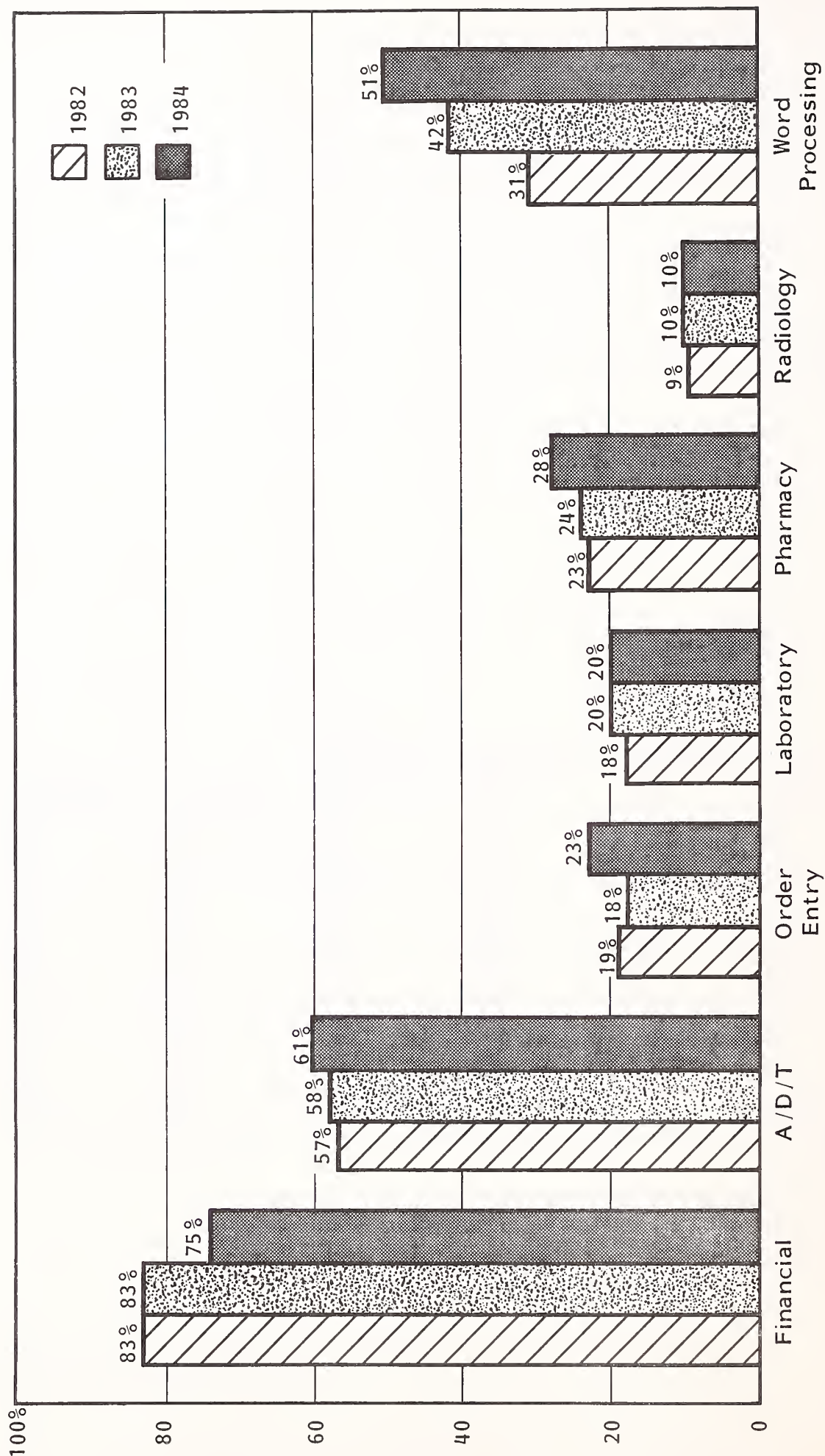
ESTIMATED 1984 DATA PROCESSING BUDGET FOR ALL 7,124 AHA HOSPITALS



Source: 1985 National Survey on Hospital Data Processing,
Medical Systems Division, University of Florida.

EXHIBIT III-10

APPLICATION USAGE AMONG HOSPITALS CURRENTLY USING A COMPUTER SYSTEM



Source: 1985 National Survey on Hospital Data Processing,
Medical Systems Division, University of Florida.

F. MARKET DRIVERS

- In the medical market change is now the rule, not the exception. This market is stimulated by pressure from:
 - Government.
 - Insurance companies and large employers.
 - Computer product vendors.
 - Medical administrators as health care system buyers.
 - The medical and legal professions.
 - The general public.

I. GOVERNMENT'S ROLE

- Three years ago, the federal government began applying pressure on hospitals to reduce costs. It passed the 1982 Tax Equity and Fiscal Reduction Act (TEFRA) and in 1984 mandated to Medicare the requirement to use the new Diagnostic Related Group (DRG) system.
- The DRG system catalogs illnesses requiring hospitalization and determines length-of-stay and treatment guidelines for hospitals and doctors. The guidelines include the maximum dollars the hospital and doctor will be paid for services provided. This is a departure from the previous method of providing a full range of patient services and receiving 100% reimbursement from the federal government.

- In 1985, Medicare implemented its Prospective Payment System (PPS). Under PPS, reimbursements to hospitals and doctors for services rendered would be frozen at the fiscal 1985 level, rather than allow the historical 5-6% annual increase for fiscal 1986.
- At publication, the Reagan administration would like to extend the PPS freeze through fiscal 1987. Significant opposition to the extension is expected.
- Following the trend of the federal government, state and local governments are reducing the levels of funding for hospitals serving the poor.
- Beyond 1985, the federal government is considering an array of changes. Exhibit III-11 presents details of these changes. The changes are based primarily on moving from a reimbursement-based approach to a market-based approach to health care services.

2. THE ROLE OF INSURANCE COMPANIES AND EMPLOYERS

- Commercial insurers and Blue Cross are likely to adopt a prospective payment system based on some form of DRG. HMOs and PPOs will likely rely on negotiated rates with employers. Only self-pay patients will be faced with paying full charges.
- Employers are also expected to consider self-funded insurance programs and to shift more responsibility to employees through higher co-insurance and deductible requirements.
- Employers are seeking to control health care costs through direct negotiation with third parties since rising health care costs no longer represent a tiny portion of overall corporate costs. For example, health care costs currently represent more than \$300 of the total cost to build a new automobile at Ford Motor Company.

EXHIBIT III-11

POSSIBLE U.S. GOVERNMENT ACTIONS TO CONTROL HEALTH CARE COSTS

CATEGORY	POSSIBLE ACTION:
Reimbursements	Reimbursing on a competitive, not cost, basis for hospital and physician services rendered.
Capital Expenditures	Including hospital capital costs (principal, interest, depreciation, and lease payments) under the PPS umbrella.
Financing	Eliminating tax-exempt financing for all but government-owned hospitals.
Medicare	Developing, demonstrating, and evaluating outpatient PPS by 1989, thus shifting more Medicare services to an outpatient basis.
Physician Incentives	Providing economic incentives to physicians for controlling consumption of a hospital's diagnostic resources, especially the expensive CAT scans and Magnetic Resonance Imaging (MRI) tests.
Reimbursement Freeze	Proposing a one-year freeze on Medicare reimbursement of direct medical education costs.
Extended Prospective Payment System	Extending prospective payment methodologies to include Skilled Nursing Facilities (SNFs), incorporating regional cost data, or grouping patients on the basis of similar needs, characteristics, and activities of daily living.
Extended Use of DRGs and Voucher System	Developing DRGs for Hospice care and considering voucher systems and competitive bidding for long-term health care.

3. THE ROLE OF COMPUTER PRODUCT VENDORS

- Lower cost CPUs, disk storage devices, and video display products have contributed to lower system costs, thereby helping spread the use of computers by health care professionals.
- Vendors serving the medical market no longer provide products tailored to a single delivery mode (turnkey systems, facilities management, or remote computing services). Shared Medical Systems, for example, is expanding its potential market by selling turnkey systems as well as its traditional remote computing services. Although the services are sold separately, certain reports can only be generated through the remote computing service.
- Furthermore, as existing customers "outgrow" one delivery mode, their needs can be met with a replacement delivery mode, sold and serviced by the same vendor.
- More market entrants and intensified competition have resulted in reduced margins for processing services and turnkey systems vendors.
- IBM has installed its 4300 series minicomputers in approximately 400 hospitals nationwide. A significant market has emerged for packaged software running on the 4300.

4. THE ROLE OF THE HEALTH CARE DATA PROCESSING BUYER

- Information is power and, as in other industries, complete information is now required in the following health care areas:
 - Operational cost data.
 - Government reimbursement guidelines.

- Personnel cost data.
 - Patient care data.
 - Customer demographic data.
- Hospital administrators recognize the need for physician education since physicians are responsible for 75% of the charges in treating a patient. One solution to the problem of increasing health care costs may be financial rewards for physicians who provide cost-effective diagnoses and treatments.
 - The widespread publicity of declining hardware prices has resulted in better informed hospital administrators as buyers of data processing services and equipment.
 - Better informed buyers plus more skeptical boards of director have lengthened and complicated the buy cycle. Many buyers seem to be from Missouri, saying "show me," not "tell me." As a result, vendors with many referenceable customers have an advantage over new vendors with a limited number of installations.
 - Historically, major upgrades to applications software were the result of custom work done for a new, large customer. A vendor's software was as good as its most recent demanding customer. This method is expected to yield to the formation of alliances between key users (hospitals, clinics, and group/sole practioners) and the information processing supplier.
 - Future trends place the hospital information system at the center of a community medical information network linking physicians' offices, independent laboratories, nursing homes, therapists, pharmacists, and other health care providers.

5. THE ROLE OF THE MEDICAL PROFESSION

- An increase in the number of physicians as well as greater specialization have also contributed to the growth in health care expenditures. Between 1965 and 1983, the number of active physicians grew from 265,000 to more than 493,000.
- Physicians determine who will be hospitalized and what type and quantity of services patients will receive, significantly affecting total health care charges.
- Another factor in the growth of health care expenditures has been growth in medical salaries. Highly-skilled medical personnel usually can demand high salaries.
- Physician concern about malpractice suits has undoubtedly increased the number of diagnostic tests performed. Between 1972 and 1978, the number of tests per 1,000 visits to physicians increased by 82%.

6. THE GENERAL PUBLIC'S ROLE

- Increased longevity has contributed to the growth in health care expenditures. More of the U.S. population is age 85 and over than ever before.
- Those over age 65 suffer more frequently from chronic diseases and physical impairment, thus using a disproportionate amount of health care expenditures.
- The public has become more litigious, willing to enter an adversarial relationship over what previously may have been a relatively minor matter.
- Medical insurance (and increasingly dental and optometric insurance) may be seen by employees as a right or by employers as a necessary evil to attract and maintain employees in highly competitive industries.

IV MARKET SIZE, GROWTH, AND SEGMENTATION

IV MARKET SIZE, GROWTH, AND SEGMENTATION

A. TURNKEY SYSTEMS

1. MARKET SIZE

- The medical turnkey systems market in 1985, estimated at \$515 million, grew 16% from 1984's revenues of \$445 million (see Exhibit IV-1).

2. MARKET FORECAST

- INPUT expects sales of turnkey systems into medical applications between 1985 and 1990 to experience faster growth, at 18% total, than the overall turnkey systems market (see Exhibit IV-2).
- The physician segment is expected to grow most rapidly of the three medical segments. Nevertheless, INPUT expects user expenditures in the hospital segment to be 3.5 times the expenditures of the second-place physician segment.

3. MARKET SEGMENTATION

- Minicomputer-based systems are the backbone of the medical turnkey marketplace. In 1985, minicomputer-based turnkey systems represented 60% of the number of systems sold, accounting for 88% of the dollar value (see Exhibit IV-3 for details).

EXHIBIT IV-1

MEDICAL MARKET TURNKEY SYSTEMS USER EXPENDITURES, 1984-1985

MARKET SEGMENT	USER EXPENDITURES (\$ Millions)		GROWTH RATE
	1984	1985	
Hospitals	\$343	\$397	-
Physicians	89	103	-
Other Medical	13	15	-
Total	\$445	\$515	16%

EXHIBIT IV-2

MEDICAL MARKET TURNKEY SYSTEMS USER EXPENDITURE FORECAST, 1985-1990

MARKET SEGMENT	USER EXPENDITURES (\$ Millions)		AAGR 1985-1990
	1985	1990	
Hospitals	\$397	\$895	-
Physicians	103	250	-
Other Medical	15	35	-
Total	\$515	\$1,180	18%

EXHIBIT IV-3

SALES OF MINICOMPUTER-BASED VERSUS MICROCOMPUTER-BASED MEDICAL TURNKEY SYSTEMS, 1985

PROCESSOR-BASED SYSTEM	PERCENT OF TOTAL SYSTEMS	DOLLAR VALUE OF SYSTEMS (\$ Millions)
Minicomputer-Based Medical Turnkey Systems	63%	\$450
Microcomputer-Based Medical Turnkey Systems	37	65
Total	100%	\$515

- Microcomputer-based medical turnkey systems are expected to grow at a faster rate than minicomputer-based systems. However, the overwhelming dollar value of systems shipped will remain with minicomputer-based turnkey systems.

B. PROCESSING SERVICES

I. MARKET SIZE

- The 1985 market for processing services, estimated at \$601 million, grew 15% from 1984's revenues of \$522 million (see Exhibit IV-4).
- Expenditures by the hospital segment accounted for 84% of the 1985 expenditures by the three market segments.

2. MARKET FORECAST

- INPUT expects purchases of medical application processing services between 1985 and 1990 to experience faster growth than the overall processing services market (see Exhibit IV-5).
- The physician segment is expected to grow the most rapidly of the three medical segments. Nevertheless, INPUT forecasts user expenditures in the hospital segment at greater than five times those of the second-place physician segment.

3. MARKET SEGMENTATION

- Interactive remote computing services (RCS) dominate the medical processing market segment. In 1985, RCSs represented 70% of the number of trans-

EXHIBIT IV-4

MEDICAL MARKET PROCESSING SERVICES
USER EXPENDITURES, 1984-1985

MARKET SEGMENT	USER EXPENDITURES (\$ Millions)		GROWTH RATE
	1984	1985	
Hospitals	\$439	\$505	-
Physicians	73	84	-
Other Medical	10	12	-
Total	\$522	\$601	15%

EXHIBIT IV-5

MEDICAL MARKET PROCESSING SERVICES USER EXPENDITURE FORECAST, 1985-1990

MARKET SEGMENT	USER EXPENDITURES (\$ Millions)		AAGR 1985-1990
	1985	1990	
Hospitals	\$505	\$1,072	16%
Physicians	84	197	19
Other Medical	12	26	17
Total	\$601	\$1,295	17%

actions, yet accounted for 85% of the dollar value of user expenditures for processing services (see Exhibit IV-6).

- Users in the medical market segment are moving toward integrated, on-line processing services.

EXHIBIT IV-6

REMOTE COMPUTING SERVICES VERSUS BATCH PROCESSING IN U.S. MEDICAL MARKET, 1985

PROCESSING SERVICE MODE	PERCENT OF TOTAL PROCESSING	DOLLAR VALUE OF INFORMATION PROCESSING (\$ Millions)
Remote Computing Services	70%	\$511
Batch Processing Services	30	90
Total	100%	\$601

V USER REQUIREMENTS

V USER REQUIREMENTS

A. REQUIREMENTS OF HOSPITALS, HMOs, AND PPOs

I. OVERVIEW

- Hospital information systems are made up of four major components:
 - Patient information.
 - Departmental information.
 - Financial information.
 - Decision support.
- A complete hospital information system comprises many subsystems which may include some or all of the following:
 - Nursing.
 - Dietary.
 - Laboratory.

- Medical records.
- Occupational therapy.
- Physical therapy.
- Radiology.
- Respiratory therapy.
- Speech and hearing services.
- Mental health services.
- Activity therapists (music, art, dance, and recreation).

2. LARGE MEDICAL ORGANIZATION DATA PROCESSING REQUIREMENTS

- As recently as 1983, an estimated 30% of hospital per diem costs were used to pay for information processing.
- The major software requirements of large hospitals, HMOs, and PPOs (those with greater than 400 beds) are shown in Exhibit V-1.
- Designing the software is a complex task based on the number and nature of interrelated information requirements. An example of this complexity is a hospital radiology subsystem shown in Exhibit V-2.
- Large medical organizations want primarily high quality software with timely and complete updates. The change from a reimbursement-based to a cost-based structure is behind the need for timely, on-line information (see Exhibit V-3). Large user purchase criteria are classified into three groups (A, B, and C) corresponding to high, medium, and low user rankings.

EXHIBIT V-1

SOFTWARE REQUIREMENTS FOR LARGE MEDICAL ORGANIZATIONS

MAJOR CATEGORY	KEY REQUIREMENTS
Patient Care	Admitting Transfer Discharge Nurse Station Order Entry Results Reporting
Financial Management	Accounts Receivable Accounts Payable General Ledger Payroll Cost Analysis Patient Billing
Laboratory Pharmacy Radiology	See Exhibit V-2

EXHIBIT V-2

RADIOLOGY SUBSYSTEM SOFTWARE CAPABILITIES CHECKLIST

CATEGORY	SOFTWARE REQUIREMENTS
Patient Administration	<ul style="list-style-type: none"> ● Registration ● Order Entry ● Exam History ● Printed Output <ul style="list-style-type: none"> - Requisition - Flash Card - Transportation Slip - Film Pull Request - Film Jacket Label (for New Patients) ● Workload Reporting ● Quality Assurance Reporting ● Automatic Charge Capture ● Radiologist Billing System Interface ● Hospital Information System Interface (Two-Way)
Scheduling	<ul style="list-style-type: none"> ● Schedule Patients ● Precedence Checking ● Duplicate Order Checking ● Allowed Rooms ● Overbooking (With Password) ● Print Schedule for Patient, Room, Nursing Station ● Exam Preparation Instructions ● Resource Utilization Statistics

EXHIBIT V-2 (Cont.)

RADIOLOGY SUBSYSTEM SOFTWARE CAPABILITIES CHECKLIST

CATEGORY	SOFTWARE REQUIREMENTS
Patient Status	<ul style="list-style-type: none"> ● Capture of Data/Events ● Patient Arrival/Departure ● Exams Performed ● Repeat Analysis ● Film Utilization ● Technologist Identification ● Detailed Statistical and Management Reporting
Interpretation/Reporting	<ul style="list-style-type: none"> ● Conventional Dictation and Transcription ● Precoded Results Reporting ● Approval by Staff Radiologist ● Resident Reporting/Approval ● Results Inquiry ● Flexible Report Sort/Print Options: <ul style="list-style-type: none"> - Ordering Physician - Nursing Station - Patient Unit Number - Transcriptionist - Reporting Radiologist
Film Library Management	<ul style="list-style-type: none"> ● Film Jacket Tracking ● Authorized Borrowers List ● Multiple Film Libraries ● Temporary and Permanent Transfers ● Delinquency Report ● Reminder Letters

EXHIBIT V-3

LARGE MEDICAL TURNKEY SYSTEM USER BUYING CRITERIA

GROUP	BUYING CRITERIA
A	<ul style="list-style-type: none"> ● Top-Ranked <ul style="list-style-type: none"> - Timeliness of Software Updates - Completeness of Software Updates - System Growth or Expansion - Flexibility of Applications Software - Performance/Quick System Response Time - Documentation (Quality and Completeness)
B	<ul style="list-style-type: none"> ● Middle-Ranked <ul style="list-style-type: none"> - Customer Training - Reliability of System - Breadth of Applications Software - Vendor Reputation - Hardware Maintenance - Real Time Financial Information - Completeness of System - Vendor Commitment - Capability to Integrate with Other Installed Systems - Vendor Financial Stability
C	<ul style="list-style-type: none"> ● Bottom-Ranked <ul style="list-style-type: none"> - Technological Considerations - Price - Delivery

- Vendors of turnkey medical systems misperceive large user buying criteria. According to Exhibit V-4, vendors believe large buyers emphasize vendor-related factors. Exhibit V-5 indicates large buyers favoring software-related purchase factors.
- Exhibit V-5 compares buying factors listed by large medical user organizations with vendor perceptions of what factors these buyers seek in a turnkey system. Major differences are noted in the following areas:
 - Timeliness of software updates.
 - Completeness of software updates.
 - Flexibility of applications software.
 - Documentation (quality and completeness).
 - Price.
- Other important criteria shown in Exhibit V-5 with some differences between user and vendor rankings include:
 - Customer training.
 - Vendor reputation.
 - Vendor financial stability.
- Large hospitals, HMOs, and PPOs cite four primary areas where vendors could improve their systems:
 - Flexibility.
 - Cost.

EXHIBIT V-4

VENDOR PERCEPTIONS OF LARGE MEDICAL TURNKEY SYSTEM USER BUYING CRITERIA

GROUP	BUYING CRITERIA
A	<ul style="list-style-type: none"> ● Top-Ranked <ul style="list-style-type: none"> - Price - Performance/Quick System Response Time - Vendor Reputation - Vendor Financial Stability
B	<ul style="list-style-type: none"> ● Middle-Ranked <ul style="list-style-type: none"> - Capability to Integrate with Other Installed Systems - Real Time Financial Information - Reliability of System - Technological Considerations - Completeness of System - System Growth or Expansion - Delivery
C	<ul style="list-style-type: none"> ● Bottom-Ranked <ul style="list-style-type: none"> - Customer Training - Documentation (Quality and Completeness) - Flexibility of Applications Software - Timeliness of Software Updates - Completeness of Software Updates

EXHIBIT V-5

DIFFERENCES BETWEEN LARGE MEDICAL TURNKEY SYSTEM USER BUYING CRITERIA AND VENDOR PERCEPTIONS

BUYING CRITERIA	GROUP RANK BY CATEGORY OF RESPONDENT	
	USER	VENDOR
Timeliness of Software Updates	A	C
Completeness of Software Updates	A	C
Flexibility of Applications Software	A	C
Documentation (Quality and Completeness)	A	C
Customer Training	B	C
Vendor Reputation	B	A
Vendor Financial Stability	B	A
Price	C	A

Legend: "A" indicates overall high user ratings.

"B" indicates overall medium user ratings.

"C" indicates overall low user ratings.

- System growth/expansion.
- Performance.
- Fundamentally, hospitals want:
 - Integration of data; i.e., a single entry of data into the system.
 - Common information, not common interfaces.
 - More flexibility or functionality built into the system at a reasonable cost.
 - Applications software which helps hospitals meet an increasing array of requirements from the government and third-party payment organizations.
- However, vendors find it difficult to develop a flexible system at reasonable cost--the last 20% of the functionality of a computer system represents 80% of the cost, time, and development effort. Furthermore, vendors want their released software to be consistent to ease customer support requirements.

3. SMALL MEDICAL ORGANIZATION DATA PROCESSING REQUIREMENTS

- Primarily as a result of declining hardware prices, data processing in medium to small hospitals, now done largely through remote processing services, is rapidly moving toward affordable turnkey systems.
- Although large HMOs are concerned with cost control, small HMOs are concerned with costs of using the services of outside practitioners.
- Small medical organizations recognize that they cannot provide all the services offered by large medical organizations. Much of their efforts are

concentrated on evaluating and comparing costs for specific diagnoses and treatments by third-party providers. Exhibit V-6 lists medical, financial, and marketing information goals for small medical organizations.

- Processing services actively serve the small medical organization and, based on INPUT surveys, understand the needs of their customers relatively well. Exhibits V-7, V-8 and V-9 compare vendor and user perceptions of small medical organization processing service user buying criteria. Only three differences exist between processing service users and vendors, specifically:
 - Flexibility of software.
 - Documentation (quality and completeness).
 - Customer training.
- Turnkey vendors are actively courting small medical organizations. Exhibits V-10, V-11, and V-12 compare vendor and user perceptions of small medical organization turnkey system user buying criteria. The following differences exist between user buying criteria and vendor perceptions of those criteria:
 - Customer training.
 - Documentation (quality and completeness).
 - Vendor commitment to the small medical establishment market.

4. USE OF MICROCOMPUTERS IN HEALTH CARE ORGANIZATIONS

- As in corporate data processing environments, microcomputers are proliferating in large and medium hospitals. Future directions include access by micros to the hospital's mainframe data base for analysis and update.

EXHIBIT V-6

INFORMATION REQUIREMENTS FOR SMALL MEDICAL ORGANIZATIONS

CATEGORY	INFORMATION GOALS
Medical	<ul style="list-style-type: none"> ● Comparing Standards of Medical Practice ● Comparing Costs Among Providers of Services ● Comparing Cost Differences of Alternative Treatments for Particular Diagnoses ● Improving the Productivity of Providers ● Assessing the Costs of Referrals to Outside Physicians
Financial	<ul style="list-style-type: none"> ● Reducing the Amount of Information Circulated on a Regular Basis ● Understanding the Cost of Procedures and Services
Marketing	<ul style="list-style-type: none"> ● Improving Forecasts of Demand for Services ● Improving Information of Patient Utilization of Services

EXHIBIT V-7

SMALL MEDICAL ORGANIZATION BUYING CRITERIA
FOR DATA PROCESSING SERVICES

GROUP	BUYING CRITERIA
A	<ul style="list-style-type: none">● Top-Ranked<ul style="list-style-type: none">- Manpower Savings- Timeliness of Software Updates- Meeting Government Reporting Requirements- Flexibility of Software- Overall Cost Effectiveness- Documentation- Hardware/Software Service- Customer Training
B	<ul style="list-style-type: none">● Middle-Ranked<ul style="list-style-type: none">- Facilities and Equipment Savings- Performance/Quick System Response Time
C	<ul style="list-style-type: none">● Bottom-Ranked<ul style="list-style-type: none">- None

EXHIBIT V-8

DATA PROCESSING SERVICE VENDOR PERCEPTIONS
OF SMALL USER BUYING CRITERIA

GROUP	BUYING CRITERIA
A	<ul style="list-style-type: none"> ● Top-Ranked <ul style="list-style-type: none"> - Facilities and Equipment Savings - Timeliness of Software Updates - Meet Government Reporting Requirements - Manpower Savings
B	<ul style="list-style-type: none"> ● Middle-Ranked <ul style="list-style-type: none"> - Performance/Quick System Response Time - Overall Cost - Hardware and Software Service
C	<ul style="list-style-type: none"> ● Bottom-Ranked <ul style="list-style-type: none"> - Flexibility of Software - Documentation (Quality and Completeness) - Customer Training

EXHIBIT V-9

DIFFERENCES BETWEEN SMALL MEDICAL PROCESSING SERVICES USER BUYING CRITERIA AND VENDOR PERCEPTIONS

BUYING CRITERIA	GROUP RANK BY CATEGORY OF RESPONDENT	
	USER	VENDOR
Flexibility of Software	A	C
Documentation (Quality and Completeness)	A	C
Customer Training	A	C

Legend: "A" indicates overall high user ratings.

"B" indicates overall medium user ratings.

"C" indicates overall low user ratings.

EXHIBIT V-10

SMALL MEDICAL ORGANIZATION BUYING CRITERIA
FOR TURNKEY SYSTEMS

GROUP	BUYING CRITERIA
A	<ul style="list-style-type: none">● Top-Ranked<ul style="list-style-type: none">- Customer Training- Hardware Maintenance- Performance/Quick System Response Time- Documentation (Quality and Completeness)- Vendor Commitment to Small Medical Establishment Market
B	<ul style="list-style-type: none">● Middle-Ranked<ul style="list-style-type: none">- Vendor Financial Stability- Price- System Growth or Expansion
C	<ul style="list-style-type: none">● Bottom-Ranked<ul style="list-style-type: none">- Delivery- Technological Considerations

EXHIBIT V-11

VENDOR PERCEPTIONS OF SMALL MEDICAL ORGANIZATION BUYING CRITERIA FOR TURNKEY SYSTEMS

GROUP	BUYING CRITERIA
A	<ul style="list-style-type: none"> ● Top-Ranked <ul style="list-style-type: none"> - Price - Vendor Financial Stability - Technological Considerations
B	<ul style="list-style-type: none"> ● Middle-Ranked <ul style="list-style-type: none"> - Performance/Quick System Response Time - System Growth or Expansion - Hardware Maintenance
C	<ul style="list-style-type: none"> ● Low-Ranked <ul style="list-style-type: none"> - Vendor Commitment to Small Medical Establishment Market - Customer Training - Documentation (Quality and Completeness) - Delivery

EXHIBIT V-12

DIFFERENCES BETWEEN SMALL MEDICAL TURNKEY SYSTEM USER BUYING CRITERIA AND VENDOR PERCEPTIONS

BUYING CRITERIA	GROUP RANK BY CATEGORY OF RESPONDENT	
	USER	VENDOR
Customer Training	A	C
Documentation (Quality and Completeness)	A	C
Vendor Commitment to Small Medical Establishment Market	A	C
Technological Considerations	C	A

Legend: "A" indicates overall high user ratings.

"B" indicates overall medium user ratings.

"C" indicates overall low user ratings.

- The software module needs of small and medium hospitals are fundamentally the same as those of a large hospital (see above)--small organizations simply need less raw computer horsepower. However, software running on less powerful microcomputers may not incorporate all the features and functionality available for a high performance minicomputer or mainframe.
- "Current generation" information systems software modules will be integrated through advanced data communications networking methodologies. INPUT expects the use of microcomputers to move toward sophisticated terminals for access to larger minicomputer- and mainframe-based systems.
- Networks of microcomputers are limited by their design to the single user doing a single task. Multi-user minicomputers with operating system software are most likely to prosper in this environment.

5. HOSPITAL INFORMATION SUBSYSTEMS

- Hospital requirements extend well beyond turnkey systems or processing services for financial reporting. Departmental subsystems featuring software integration capabilities with related departments offer opportunities for niche vendors.
- This chapter discusses specific information system requirements for:
 - Nursing information systems.
 - Dietary analysis systems.
 - Automated laboratory systems.

a. Requirements For Nursing Information Systems

● Nursing information systems require modules for:

- Patient care.
 - . Medication.
 - . Dietary restrictions.
 - . Identification, tracking, and analysis of infections.
- Scheduling of nursing personnel.
- Training of nursing personnel.
- Budget and financial records.
- Strategic and tactical department planning.
- Research.
- Interdepartmental communication.
- Report generation.

● Purchasers of nursing information systems seek these benefits:

- Cost control.
- Effective scheduling of nurses with special training to meet anticipated patient loads.
- Linking departmental nursing systems with other service departments.

b. Requirements for Dietary Analysis Systems

- Dietary analysis systems require modules for:
 - Food intake assessment.
 - Daily recommended dietary allowance (by patient).
 - Daily nutrient analysis.
 - Recipe analysis.
 - Cost and budget analysis.
 - Recipe storage.
 - Ingredient substitution.
 - Conversions (metric/standard).
- Purchasers of dietary analysis systems seek:
 - Patient feeding cost information.
 - Nutrition analysis for each patient.
 - Labor and departmental overhead cost information.
 - Improvements in ordering consumables and disposables.

c. Requirements For Automated Laboratory Systems

- The following functions are basic to laboratory automation:
 - On-line order entry interface.
 - Results reporting interface.
 - On-line admissions, discharge, transfer interface.
 - On-line instrument data acquisition.
 - Work lists and schedules.
 - Lab reports.
- Purchasers of automated lab systems seek these benefits:
 - Service improvement.
 - Quality-of-care improvement.
 - Productivity improvement.
 - Realized cost savings.

6. FUTURE DIRECTIONS IN MEDICAL CARE

- The hospital information system may be at the center of a large network connecting physicians, HMOs, alternative care units, ambulatory units, "emergicenters," and "surgicenters."

- Medical care will likely be broken down by the severity of the illness--the most severe cases go to primary care hospitals, moderate-severity cases are sent to secondary and tertiary hospitals. The least severe cases can be treated at home.
- If the previous scenario comes to pass, then networks will be very important in linking the primary, secondary, and tertiary care providers.
- There will likely be more negotiated contracts for medical services between employers and local hospitals or HMOs.
- Convenience may be as important a factor as cost-effectiveness in health care.

7. OPPORTUNITIES FOR HOSPITAL INFORMATION SYSTEM VENDORS

- Systems integrating nursing and pharmacy functions are now available.
- "Next generation" hospital information systems are likely to include:
 - Integrated subsystems.
 - Extensive data communications capabilities.
- The market opportunity in nursing is the clinical area, encompassing:
 - Research.
 - Quality assurance.
 - Patient education.
 - Staff education.
 - Artificial intelligence in hospital-based nursing.

- According to the American Hospital Association, only 30% of U.S. hospitals currently use computer technology to implement one or more lab functions. Major opportunities exist in automating:
 - Lab work for inpatients.
 - Lab work for outpatients.
 - Hospitals with less than 350 beds.
- Another opportunity for vendors is providing information systems for occupational health specialists. Occupational health issues relate to chemical, toxic substances, and safety in the workplace. Urban medical centers could become regional clearinghouses for this information.
- Vendors must perform better "needs assessments" of their customer base before developing new applications software. To do this, successful vendors will take a proactive approach (rather than a reactive approach) to customers' requirements definition and planning.
- Telecommunications is the "next frontier" in hospital information systems technology. Many of these technologies will support extensive patient education programs. Opportunities will abound in:
 - Computer conferencing.
 - Satellite-delivered programs (for physician and staff education and training).
 - Electronic mail.
 - Videotext.
 - Easier access to on-line information services.

B. REQUIREMENTS OF PHYSICIANS, DENTISTS, AND OTHER DOCTORS

I. GENERAL REQUIREMENTS

- Medical and dental practitioners receive a significant portion of their revenues as reimbursements through such third parties as Blue Cross/Blue Shield (the "Blues") and state dental reimbursement plans. These third parties impose certain requirements on the physician or dentist.
 - Insurance carriers and other third parties accept standard American Medical Association forms for reporting services rendered by physicians.
 - Dentists must complete proprietary forms used by dental insurance carriers before they can be reimbursed for services provided. Few dental insurance carriers accept the standard American Dental Association form.
 - Insurance companies accept computer tapes from physicians for claims; they do not take computer tapes from dentists.
 - Some insurance carriers insist that patients sign the forms, thus delaying processing. Creative doctors/dentists maintain an authorized signature on file.
 - Doctors and dentists are aware that typed forms are processed faster by the insurance carriers, hence, they get paid by the insurance carrier more quickly.
- Computers in physician and dental practices reduce these common errors:
 - Incorrectly completed forms.

- Omissions of work done by the doctor/dentist.
- Misplaced patient files, resulting in no bill ever being sent to the patient or insurance carrier.
- Physicians' information processing requirements are listed in Exhibit V-13. This background information is important when prioritizing market opportunities, discussed in the following section.
- Vendors must be certain to address all buyer requirements shown in Exhibit V-13. INPUT surveys of physician and dentist turnkey system buying criteria (shown in Exhibit V-14) indicate completeness of product offering and service are of paramount importance.

2. OPPORTUNITIES FOR VENDORS OF MEDICAL/DENTAL TURNKEY SYSTEMS

- According to a 1984 survey by Dental Economics magazine, only 8.3% of the nation's dental offices (with 92,000 practicing dentists) have computer systems, up from 3% in 1982. Sales opportunities for microcomputer-based systems are very strong, provided the vendor emphasizes the key advantages of:
 - Properly completed forms.
 - Typed forms for faster processing and reimbursement by third parties.
 - No unbilled patients.
- Within medical and dental practices with an installed turnkey system, INPUT identifies opportunities for sales of add-on software modules. Word processing, relational data bases (to replace older data bases using hierarchical

EXHIBIT V-13

PHYSICIANS' INFORMATION PROCESSING REQUIREMENTS

CATEGORY	USER REQUIREMENT
Scheduling of Patients	<ul style="list-style-type: none"> ● 15- or 20-minute Intervals
Medical Records	<ul style="list-style-type: none"> ● Storage ● Retrieval
Communication with Hospitals to Determine	<ul style="list-style-type: none"> ● Availability of Beds ● Results of Tests for Inpatients
Financial Data and Reports	<ul style="list-style-type: none"> ● Billing ● Accounts Receivable ● Accounts Payable ● General Ledger ● Payroll ● Benefits
Productivity Measurement and Analysis	<ul style="list-style-type: none"> ● Procedure Codes ● Personnel Codes
Inventory Control	<ul style="list-style-type: none"> ● Supplies ● Perishable Medications
Other Requirements	<ul style="list-style-type: none"> ● Number of Terminals Needed ● Number of Modem(s) Required ● Unique Requirements of Each Medical Specialty ● Demonstrations ● Documentation ● Price Range ● Financing Available ● "Bug" Reporting and Follow-Up

EXHIBIT V-14

PHYSICIAN AND DENTIST BUYING CRITERIA FOR TURNKEY SYSTEMS

GROUP	BUYING CRITERIA
A	<ul style="list-style-type: none"> ● Top-Ranked <ul style="list-style-type: none"> - Completeness of Product Offering - Hardware Maintenance - Software Updates and "Bug Fixes" - Customer Training - Vendor Commitment to Physician/Dentist Market - "Single Call" Problem Resolution - Performance/Quick System Response Time - Documentation (Quality and Completeness)
B	<ul style="list-style-type: none"> ● Middle-Ranked <ul style="list-style-type: none"> - Price - Vendor Financial Stability - System Growth or Expansion - Technological Considerations - Delivery

structures), data communications, and spelling checkers can all be sold at or near list price, thereby boosting revenues and maintaining account control.

- Add-on hardware for established turnkey users is another major opportunity. Additional terminals, printers, add-in main memory, and disk storage are the more obvious hardware add ons. Consider sales of data communications hardware and file servers to help consolidated individual or small group practices.
- Vendors may profitably offer hardware service through third parties. The service reinforces the "single-call service" that customers want at a profit to the vendor.
- An overlooked area is customer education and training. While the doctor is required to maintain continuing professional education credits, no requirement is made of the staff to keep current. Computer-based dental assistant or office manager training on a local scale represents a possible opportunity. Training in the latest computer-based office management techniques maintains customer loyalty and shows mastery of the effective consultative sales technique for generating follow-on business.

C. OTHER MEDICAL ORGANIZATIONS

I. NON-HOSPITAL INFORMATION SYSTEMS

- As examples of non-hospital information systems, we will examine the requirements for:
 - Pharmacy systems.
 - Blood bank systems.
 - Ambulatory care center systems.

2. PHARMACY SYSTEMS

- The functions desired on retail and hospital pharmacy systems are:
 - On-line order entry.
 - Medication administration records.
 - Historical information for research.
 - Automated refill dispensing reports.
 - Order credit and debit.
 - Label generation.
 - Drug interaction checking.
 - Reference lookup.
 - Duplicate order checking.
- Hospital pharmacists want their computer system physically located in their work area where they can maintain control. As a result, turnkey systems are primarily installed in hospitals with less than 350 beds.
- Remote processing services are the least expensive of the three modes of computerized pharmacy support.
- Support is an important component of the pharmacy system "sell."

- The user benefits of an automated pharmacy system are:

- Productivity improvement.
- Quality-of-care improvement.
- Service improvement.
- Realized cost savings.

3. OPPORTUNITIES FOR VENDORS OF PHARMACY SYSTEMS

- In 1985, 3,200 hospitals (of approximately 7,000 total U.S. hospitals) did not have automated pharmacy systems.
- Other opportunities include improvements to existing systems, especially in the following areas:
 - User documentation.
 - "User friendliness."
 - The ability to connect additional terminals.
 - Improved flexibility.
 - Improved hardware maintenance response time.

4. TURNKEY SYSTEMS FOR BLOOD BANKS

- Blood banks, an emerging application for medical information systems, serve primarily hospital, clinical, HMO, and PPO providers of medical services.

- Exhibit V-15 provides details of the U.S. blood bank market.
- Blood bank information requirements will be fueled by:
 - An increase in blood testing for AIDS and hepatitis strains.
 - Automation of blood testing and blood typing.
 - Requirements to increase productivity and economic efficiency.
 - Improvements in blood centrifuging and testing technologies.
 - Increased competition from the impact of recombinant DNA and other products of genetic engineering and advances in the development of artificial blood.

5. TURNKEY SYSTEMS FOR AMBULATORY CARE

- A well-defined market niche is U.S. ambulatory care centers, which have increased 33% since 1983 and now number more than 5,000.
- According to a survey taken by the American Group Practice Association, 83% of ambulatory care physicians use computers.
- Most ambulatory care information systems would be used in group practices and outpatient services. The most important computer applications are:
 - Patient billing.
 - Patient scheduling.
 - Patient registration.

EXHIBIT V-15

U.S. BLOOD BANK MARKET, 1984

TYPE OF ORGANIZATION	PERCENT OF TOTAL MARKET
Non-hospital, non-profit (Red Cross)	56%
Hospitals	16
For Profit Blood Banks	6
Federal Facilities (V.A., Military Hospitals, and Military Blood Banks)	5
Miscellaneous Organizations	17
Total	100%

Note: Number of U.S. Blood Banks, 1984 = 2,000

- Procedure coding.
- Results reporting.
- Data base compilation.
- Modeling function execution.

**VI MEDICAL TURNKEY AND PROCESSING
SERVICE VENDORS**

VI MEDICAL TURNKEY AND PROCESSING SERVICE VENDORS

A. OVERVIEW

- This chapter contains profiles of processing services and turnkey companies.
- These firms may be privately or publicly owned. Stocks of publicly-owned firms are traded on the New York, American, or NASDAQ Over-The-Counter Exchange.
- INPUT uses the following format to describe each firm:
 - Name.
 - City and state.
 - Revenues for the most recent fiscal year.
 - Number of employees.
 - Public or private corporation.
 - Products or services.
 - Markets served.

- Company strategy.
- Recent activities.
- Future direction.

B. VENDOR PROFILES

I. COMPUCARE, INC. (SUBSIDIARY OF BAXTER TRAVENOL LABORATORIES), RESTON (VA)

- Founded: 1975.
- Fiscal Year 1984 Revenues: \$51.3 million.
- Employees: 850.
- Public Corporation: OTC.
- Products/Services: Turnkey systems (1% of revenue), reselling hardware (14% of revenue).
- Markets Served: Hospitals, physicians.
- Company Strategy: Compucare, primarily a supplier of professional management services, has branched out to include applications software and turnkey systems for physicians. The company is part of Baxter Travenol Corporation's strategy to be a full-line supplier to the highly fragmented health care market.

- Recent Activities: Through acquisition in 1984 Compucare entered the physician office systems market, establishing a separate division. Baxter Travenol merged with American Hospital Supply Corporation, thereby offering a full range of medical support services, supplies, and equipment.
- Future Direction: Through its pooling of interest acquisition, Baxter Travenol is likely to use Compucare as a vehicle to attack the financial and patient care segments of the hospital systems market. Compucare is developing an integrated clinical/fiscal system defined as one computer system or tightly coupled network with a single data base, operating in real time.

2. COMPUTER SCIENCES CORPORATION (CSC), MEDICAL SYSTEMS DIVISION, EL SEGUNDO (CA)

- Founded: 1959.
- Fiscal Year 1985 Revenues: \$723.5 million.
- Employees: 14,100.
- Public Corporation: NYSE, PSE.
- Products/Services: Turnkey systems (1% of total revenues), prescription drug claims processing (less than 1% of total revenues).
- Markets Served: Hospitals, pharmacies.
- Company Strategy: CSC supplies turnkey systems for patient and financial applications to large hospitals or groups of hospitals sharing DP facilities and performs facilities management services for Medicaid. Turnkey systems operate on Tandem computers.

- Recent Activities: In 1984, CSC's Medical Systems Division added eight application modules to its turnkey medical system, including pharmacy, radiology, patient appointment scheduling, inventory, and fixed asset accounting. CSC sold its Paid Prescriptions subsidiary which processed pharmacies' claims for prescription drugs.
 - Future Direction: Based on an analysis of contracts awarded to CSC, it appears that the company is actively pursuing contracts to manage state Medicaid processing programs. CSC's Medical Systems Division, after adding more turnkey system applications software, will likely attack the market for high-availability DP facilities serving more than one hospital.
3. ELECTRONIC DATA SYSTEMS (SUBSIDIARY OF GENERAL MOTORS CORPORATION), HEALTH SERVICES DIVISION, DALLAS (TX)
- Founded: 1962.
 - Fiscal Year 1984 Revenues: \$850 million (estimated).
 - Employees: 13,000.
 - Public Corporation: NYSE.
 - Products/Services: Processing services (0.5% of revenues), turnkey systems (0.5% of revenues).
 - Markets Served: Hospitals, nursing homes.
 - Company Strategy: EDS' Health Service Division primarily serves the insurance processing market. Hospitals with more than 250 beds are for the most part served through EDS' proprietary processing service. The company's turnkey systems, based on Data General or Sperry Univac minicomputers, also serve large hospitals. Systems for nursing homes, based on Integrated

Business Computer multi-user microcomputers, provide administrative and financial modules.

- Recent Activities: INPUT's files on EDS mainly contain information about the firm's acquisition by General Motors. Based on this, it is assumed that EDS will spend most of its time and money on improving GM's data processing operation.
- Future Direction: EDS has made no statements about its overall direction. The only activity reported was EDS' licensing of Cullinet's relational data base software which may not be used in health care applications. Since hospital and nursing home revenues constitute only 1% of overall business, INPUT believes EDS is de-emphasizing turnkey health care activities.

4. HBO & COMPANY, ATLANTA (GA)

- Founded: 1974.
- Fiscal 1984 Revenues: \$88.7 million.
- Employees: 1,000 (INPUT estimate).
- Public Corporation: OTC.
- Products/Services: Turnkey systems (60% of revenues).
- Markets Served: Hospitals.
- Company Strategy: HBO & Company sees the hospital as the focal point of future health care delivery systems. The company intends to offer patient, departmental, financial, and decision support information systems, as well as management consulting and facilities management services. Its primary delivery modes are turnkey systems and packaged software.

- Recent Activities: HBO & Company merged with Amherst & Associates, a leading medical industry consulting firm, and Mediflex, a supplier of software products and facilities management and decision support services.
 - Future Direction: HBO & Company has stated publicly that it will initially focus on hardware maintenance, systems for home health care agencies, and opportunities in the international marketplace.
5. MCDONNELL DOUGLAS HEALTH SYSTEMS COMPANY (DIVISION OF MCDONNELL DOUGLAS CORPORATION), ST. LOUIS (MO)
- Founded: 1960.
 - Fiscal Year 1984 Revenues: \$700 million (INPUT estimate).
 - Employees: 9,000 (INPUT estimate).
 - Public Corporation: NYSE.
 - Products/Services: Processing services (55% of revenues), turnkey systems (18% of revenues).
 - Markets Served: Hospitals, clinics, medical groups, laboratories.
 - Company Strategy: MDHSC wants to be a leading player in the health services market through its acquisitions of Tymshare and Vitek Systems. The company's strategy emphasizes communications network capabilities and timesharing in support of turnkey systems.
 - Recent Activities: Through the acquisition of Science Dynamics, MDHSC moved into the physician market, a key feeder into its future network with the hospital at the network's center.

- Future Direction: The company plans to integrate financial and patient care information with clinical information. For the future, MDHSC sees fewer, but larger, hospitals which the company will serve.
6. MEDITECH (MEDICAL INFORMATION TECHNOLOGY, INC.), WESTWOOD (MA)
- Founded: 1969.
 - Fiscal Year 1984 Revenues: \$19.9 million.
 - Employees: 260.
 - Public Corporation: No.
 - Products/Services: Turnkey systems (8% of revenues), processing services (10% of revenues).
 - Market Served: Hospitals.
 - Company Strategy: MEDITECH develops applications software products for DEC, Data General, and IBM minicomputers and, to a lesser extent, offers remote computing and facilities management services to the health care industry. Primary customers include hospitals, private laboratories, and prepaid health plans. MEDITECH's remote computing service uses its proprietary software.
 - Recent Activities: MEDITECH added software, giving it a total of 16 patient care and financial modules.
 - Future Direction: Although the company is primarily a software developer, it sells remote computing services to hospitals. Since software sells systems,

MEDITECH would be expected to sell turnkey systems based on DEC, DG, and IBM minicomputers.

7. SHARED MEDICAL SYSTEMS CORPORATION (SMS), MALVERN (PA)

- Founded: 1969.
- Fiscal Year 1984 Revenues: \$256.8 million.
- Employees: 2,800.
- Public Corporation: OTC.
- Products/Services: Remote processing (75% of revenues), turnkey systems (20% of revenues).
- Markets Served: Hospitals, group practices, clinics.
- Company Strategy: SMS serves all segments of the hospital market except those institutions with less than 100 beds. SMS places its system at the center of a network linking hospitals, Medicare organizations, insurance companies, government agencies, and hospital supply companies.
- Recent Activities: In the past three years, SMS established a subsidiary to offer its products outside the U.S. SMS aggressively pursues renewal of processing services contracts with large groups that represent many hospitals.
 - The company offers on-line software modules for financial management and patient care and turnkey systems running on DEC and IBM 4300 minicomputers.
 - To keep pace with other vendors, SMS announced in 1984 a mainframe-based information system with financial, clinical, and administrative processing for hospitals.

- The company expanded the role of PCs in its hospital information networks through such applications as nurse staffing and Medicare cost reporting.
- Future Direction: SMS sees an active market for replacement of outdated financial systems. Its role in the center of a large, integrated network may become a reality since data communications is becoming a driving force in the hospital data processing market. INPUT expects SMS to market more single- and multi-user microcomputer systems to reach new applications and customers.

VII CONCLUSIONS AND RECOMMENDATIONS

VII CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

I. THE MEDICAL MARKET

- Although the number of hospitals is shrinking (due to mergers, acquisitions, and consolidations), strong opportunities for turnkey systems vendors exist in the replacement market for financial systems and new installations of integrated hospital information systems.
- Although the use of data processing services is now the leading delivery mode, INPUT expects rapid sales growth of integrated minicomputer-based turnkey systems and limited function microcomputer-based products.
- Hospitals are unique service entities. Based on different services offered, two similar bed-size hospitals will have different data processing requirements.
- Less than 25% of hospitals currently using data processing systems or services have installed modules for order entry, laboratory, pharmacy, and radiology applications.
- Although many organizations are pressuring hospitals to reduce costs, the greatest impetus is coming from the federal government, insurance companies, and large employers.

- Future trends place the hospital information system at the center of the community medical information network linking physician's offices, independent laboratories, nursing homes, therapists, pharmacists, and other health care providers.

2. USER REQUIREMENTS

- Data processing in hospitals must become more efficient and less costly. As recently as 1983, an estimated 30% of per diem charges were used to pay for data processing.
- According to INPUT surveys, software-related criteria are the key factors behind large hospitals' purchases of turnkey systems. Vendors, however, believe customers perceive price and vendor-related issues as primary purchase criteria for turnkey systems.
- Small medical organizations are most concerned with manpower savings, timeliness of software updates, and flexibility of software as key data processing service purchase criteria.
- When small medical organizations shop for turnkey systems, key purchase criteria include customer training, hardware maintenance, and rapid system response time.
- Although microcomputers are proliferating in health care organizations, INPUT sees their use as limited to single user tasks--data analysis, word processing, and small data base applications. Small hospitals will require true multi-user, multi-tasking systems or access to an on-line processing data service to provide full support to meet their data processing requirements.
- Computers offer tremendous advantages to physicians and dentists, among them:

- Faster processing of claims by third parties.
 - Use of "boilerplate" to complete repetitive forms.
 - Ensured submission of bills for all work completed.
- When purchasing a turnkey system, physicians and dentists are most concerned about the completeness of product offering, hardware maintenance, software updates and "bug fixes," and customer training.

3. VENDORS

- The leading vendors of data processing services and turnkey systems for the medical market are positioning themselves as full-line suppliers, selling hardware, software, hardware and software service, and training.

B. RECOMMENDATIONS

I. TURNKEY SYSTEMS

- Although numerous opportunities exist in all segments of the health care market, specialization is necessary for market focus and effective utilization of vendor resources.
- "Completeness of system" is a key user purchase criterion. Based on this, INPUT recommends that new or existing vendors wishing to attack a new segment develop an integrated system rather than completing key modules with the promise of later adding other modules.

- No longer can turnkey vendors guess what user requirements are--alliances with key users, large or small, will be necessary to aid in the development of useful, integrated systems.
- Communications capabilities are the key to future business. The scenario with the hospital at the center of the health care network is plausible. Meeting user needs under this scenario will place heavy demands on data and/or voice communications.
- Turnkey system buyers are most concerned with:
 - Software features.
 - Software support.
 - Documentation.
 - Customer training.
 - Meeting government reporting requirements.
- These user criteria are all a far cry from the traditional hardware-oriented, technology-based, "bells and whistles" sales approach to turnkey systems. Successful vendors will be those who break away from past habits and aggressively pursue customer-oriented selling.
- Vendors' "features and benefits" sell must be tailored to meet specific user needs. Buyers of dietary analysis systems, for example, have different "hot buttons" than buyers of automated laboratory systems.
- INPUT cautions turnkey vendors not to get caught in the "microcomputer trap"--networks of micros cannot provide complete solutions to data processing problems requiring true multi-user architectures and operating systems.

INPUT suggests vendors position the micro as an intelligent workstation for "information workers," not as the organization's primary data processing system.

- The strongest turnkey system opportunities exist in these market segments:
 - Clinical nursing applications.
 - Hospital and independent laboratories.
 - Occupational health specialists.
 - Replacement of financial systems which compute reimbursements, not costs.
 - Doctors offices, especially physicians (who must have access to their hospitals' data bases) and dentists (with a low computerization rate).
 - Pharmacy systems.
 - Blood bank systems.
 - Ambulatory care systems.
- Other turnkey vendor opportunities include:
 - Add-in memory sales.
 - Disk storage capacity upgrades.
 - Word processing, integrated voice/data software.

- INPUT identifies eight factors for success for turnkey vendors in Exhibit VII-1. The bottom line requirement—provide the greatest number of solutions for the customer's single telephone call.
- Turnkey systems effectively solve the traditional "finger pointing" problem of hardware and applications software vendors by providing "single call service" and accountability. Providing hardware maintenance through less expensive third parties (rather than relying on the minicomputer or microcomputer manufacturer to do so) may represent further leverage for the turnkey vendor.
- The replacement market offers one of the best opportunities for medical turnkey vendors. Previous generation minicomputers and older, low-performance mainframes can be replaced with more powerful minicomputers which support integrated software environments and operate in an air-conditioned office.
- Systems integration at large hospitals and clinics is expected to represent a key market opportunity. Proprietary turnkey systems, each serving a different hospital function, must be integrated into a system with common user interfaces and system commands.
- The international market represents a large, but challenging, opportunity. The lure of a large market is offset by considerable differences in language, the buying process, government regulations (if applicable), documentation, and U.S. regulations governing the degree of sophistication allowed in exported computer equipment.
- As U.S. health care extends beyond acute care hospitals, more physician groups and individual practitioners will join the regional health care network. New market entrants are likely to require only a microcomputer-based turnkey system with extensive data communications capabilities.

EXHIBIT VII-1

FACTORS FOR SUCCESS FOR TURNKEY SYSTEM VENDORS

CATEGORY	FACTOR
Product Diversity	Offer systems that can be sold by turnkey vendors and used by remote processing services.
Integrated Products	Provide integrated communications products and services.
Software Tools	Supply advanced software development tools.
Service Capability	Offer nationwide applications software and hardware maintenance service.
One-Stop Hardware Repair	Repair hardware manufactured by other vendors.
Software Solutions	Provide timely, high quality applications software which conforms to government reporting requirements.
Documentation	Develop innovative, useful documentation with on-line help facilities.
Training and Education	Develop and offer extensive customer training and education, including updates on industry developments.
Summary	Provide the most solutions for the customer's single telephone call.

- An additional revenue source for vendors selling both processing services and turnkey systems is licensing. Modified versions of processing services software can be licensed through alternative distribution channels. This software is up-to-date, relatively bug free, documented, and able to run on multi-user, microcomputer-based systems.
- As of publication, there are abundant opportunities for mergers in the medical services marketplace. The largest firms (SMS, HBO & Company, Baxter Travenol, McDonnell Douglas Physician Services) have made their moves. Tremendous opportunities exist for reasonably priced mergers of privately-held data processing services and medical turnkey system vendors.
- As computer system buyers become more sophisticated, successful turnkey vendors or processing services must modify their selling approaches. The "consultative" sell, wherein the vendor's salesforce takes the role of outside consultant to the customer, is a proven, highly effective means of maintaining an ongoing business relationship.
- Part of the "consultative" sell, customer education and training offer excellent profit opportunities for vendors by filling customers' needs. Frequent, reasonably priced seminars reinforce the vendor's presence and enable the astute trainer to learn more about customer accounts.
- Some turnkey vendors make the source code available to customers. More hospitals will recognize the value of buying 80% of what they need, then modifying the code to meet internal requirements. Furthermore, releasing the source code shifts the responsibility to the customer for applications software maintenance.
- Turnkey system vendors must carefully choose the hardware and operating system software for their turnkey products. Overpriced hardware, although allowing the vendor to charge proportionately more for application software, ultimately results in an overpriced system.

- Other vendor considerations in selecting hardware suppliers include:
 - Upward and downward compatibility of CPUs.
 - Availability of a wide range of disk drives to meet a range of data storage requirements.
 - Nationwide (or, in a growing number of cases, worldwide) hardware and operating system software support.
 - Availability of advanced applications software development tools.
 - Financial stability, installed base, reputation of hardware supplier, and supplier commitment to the medical market.

2. PROCESSING SERVICES

- Processing services remain an excellent means for a hospital, nursing home, or doctor's office to computerize its manual operations. As a result, processing services are likely to prosper as cost-effective providers of DP services to smaller users.
- Batch data processing in hospitals in highly competitive urban and suburban markets will most likely move toward on-line data processing. Rural hospital markets may remain well served by batch data processing for the foreseeable future.
- Processing services offer excellent communications network opportunities for suburban or rural care providers through shared access to files. INPUT believes on-line processing services, based on data base-oriented applications, offer providers a relatively low-cost, low-risk introduction to communications networks.

- Part of processing services' growth can come through the addition of integrated software modules for niche applications. These suppliers can, in turn, resell their software to those users who migrate to turnkey systems, also sold by the processing services.

APPENDIX A: DEFINITIONS

APPENDIX A: DEFINITIONS

- A turnkey system comprises the hardware, systems software, and applications software to provide a solution to a customer's problem. Turnkey system vendors typically supply maintenance to the hardware and software components of the system. In short, turnkey systems represent "one-stop shopping" for customers with specific data processing problems.
- Facilities management services are provided by a third-party supplier on a contractual basis. These services generally include hardware ownership, operation and maintenance, software ownership and updates, and "internal" customer support.
- Remote computing services (RCSs) provide data processing capabilities by means of terminals at the user's site. Terminals are connected by a data communications network to the vendor's central computer. The two relevant submodes of RCS are interactive and remote batch processing.
 - Interactive RCSs are characterized by interaction of the user with the system, primarily for data entry and transaction processing. The user is on-line to the program and data files--the data files are updated immediately.
 - In remote batch processing, the user hands control of a job to the processing site computer which schedules job execution according to priorities and computing resource requirements.

- Mainframe/minicomputer applications software vendors supply only the applications software for a minicomputer or mainframe at the health care customer's site. These firms are not responsible for hardware or systems software maintenance or upgrades, only the modification to their software package.
- Microcomputer applications software vendors supply only the applications software designed to run with a microcomputer located at the customer's site. These organizations, like their mainframe/minicomputer counterparts, are responsible only for modifications or upgrades and the accompanying documentation to their proprietary software package.

APPENDIX B: SUPPLIERS

APPENDIX B: SUPPLIERS

A. HOSPITAL TURNKEY SYSTEMS (FINANCIAL AND PATIENT CARE) SUPPLIERS

- HBO & Company
Atlanta (GA)
- Shared Medical Systems
Malvern (PA)
- Dynamic Control Corporation
(Subsidiary of Baxter Travenol Laboratories, Inc.)
Longwood (FL)
- Systems Associates, Inc.
Charlotte (NC)
- Continental Healthcare Systems, Inc.
Overland Park (KS)
- Health Data Sciences Corporation
San Bernardino (CA)

- Pentamation
Mendham (NJ)
- Computer Synergy
Oakland (CA)
- American Medical International
Los Angeles (CA)
- Sentry Data Systems
Mount Prospect (IL)
- Health Information Systems
Brooklyn (NY)
- CyCare Systems, Inc.
Dubuque (IA)
- John O. Goodman & Company
Long Beach (CA)
- Technicon Data Systems
Atlanta (GA)
- Patient Healthcare Systems
Ft. Collins (CO)
- Health Micro Data Systems
Madison (WI)
- Advanced Healthcare Systems
Bethesda (MD)

- Electronic Data Systems
Dallas (TX)
- Omnicare
Tonawanda (NY)
- Advanced Medical Systems
Rockville Center (NY)
- American Data Services
Lake Bluff (IL)
- Code 3 Corporation
Salt Lake City (UT)
- Professional Hospital Services
Los Angeles (CA)
- Hospital Utilization Project
Pittsburgh (PA)
- HPI Health Care Services
Los Angeles (CA)
- American Business Computers
St. Louis (MO)

B. COMPUTER SYSTEM VENDORS SERVING THE HOSPITAL MARKET

- AT&T Information Systems*
- Burroughs Corporation

- Data General Corporation
- Digital Equipment Corporation (DEC)
- Four Phase (Division of Motorola, Inc.)
- Hewlett-Packard Company*
- Honeywell Information Systems Inc.
- IBM Corporation*
- NCR Corporation
- Texas Instruments*

* Indicates the medical market is served primarily through reseller distribution channels.

C. MEDICAL RECORDS TURNKEY SYSTEM SUPPLIERS

- Turn-Key Solutions, Inc.
Cincinnati (OH)
- BaronData
San Leandro (CA)

D. PHYSICIAN TURNKEY SYSTEM SUPPLIERS

- CyCare Systems
Dubuque (IA)
- Interpretive Data Systems
Burlington (VT)
- McDonnell Douglas Health Services Company
Hazelwood (MO)
- M/D Management Systems, Inc.
Las Vegas (NV)

E. PHARMACY TURNKEY SYSTEM SUPPLIERS

- Dynamic Control Corporation
(Subsidiary of Baxter Travenol Corporation)
Longwood (FL)
- McDonnell Douglas Health Systems Company
Hazelwood (MO)
- HBO & Company
Atlanta (GA)
- Systems Associates, Inc.
Charlotte (NC)

- Continental Medical Systems
Overland Park (KS)
- Shared Medical Systems
Malvern (PA)
- Medlab
- Electronic Data Systems
Dallas (TX)
- Hospital Data Services
- Sentry Data Systems
Mount Prospect (IL)
- Digimedics

F. RADIOLOGY TURNKEY SYSTEM SUPPLIERS

- Technicon Data Systems
Atlanta (GA)
- McDonnell Douglas Health Systems Company
Hazelwood (MO)
- MEDITECH
Westwood (MA)
- Compucare
(Subsidiary of Baxter Travenol Laboratories, Inc.)
Reston (VA)

- Shared Medical Systems
Malvern (PA)
- ADAC Laboratories
San Jose (CA)
- Electronic Data Systems
Dallas (TX)
- Systems Associates, Inc.
Charlotte (NC)

G. LABORATORY TURNKEY SYSTEM SUPPLIERS

- Labcom
- Systems Analysis Corporation
- SmithKline Beckman
Philadelphia (PA)
- Shared Medica Systems
Malvern (PA)
- MEDITECH
Westwood (MA)
- McDonnell Douglas Health Services Company
Hazelwood (MO)

- Technicon Data Systems
Atlanta (GA)
- Community Health Computing
- Medlab
- Compucare
(Subsidiary of Baxter Travenol Laboratories, Inc.)
Reston (VA)
- Sunquest
Tucson (AZ)
- Laboratory Management Systems
(Subsidiary of SmithKline Beckman Corporation)
Philadelphia (PA)
- Commonwealth Clinical Systems, Inc.
Charlottesville (VA)
- HBO & Company
Atlanta (GA)

H. NURSING HOME TURNKEY SYSTEM SUPPLIERS

- Reliable Health Systems
Brooklyn (NY)
- Columbia Systems Architects
Columbia (SC)
- Delta Pro Management, Inc.

I. DATA PROCESSING SERVICES

- Shared Medical Systems
Malvern (PA)
- HBO & Company
Atlanta (GA)
- Electronic Data Systems Corporation
Dallas (TX)
- McDonnell Douglas Automation Company
Torrance (CA)
- CyCare Systems
Dubuque (IA)
- Information Science Inc.
Montvale (NJ)

J. HOSPITALS SELLING TURNKEY SYSTEMS

- American Medical International
Professional Hospital Services (subsidiary)
Los Angeles (CA)
- Evangelical Health Systems
Oak Brook (IL)

- Parkview Memorial Hospital
Fort Wayne (IN)
- Rush-Presbyterian-St. Luke's Medical Center
Chicago (IL)
- Lutheran Hospital Society of Southern California
Pacific Health Resources (subsidiary)
Los Angeles (CA)

APPENDIX C: USER QUESTIONNAIRE

APPENDIX C

MEDICAL PROCESSING SERVICES/TURNKEY SYSTEMS MARKET

USER QUESTIONNAIRE

1. Do you use a computer system in your _____ (insert:
practice/hospital/pharmacy/etc.)?

____ Yes (continue) ____ No (terminate)
2. What were the four main reasons you even considered buying a computer system?

3. a. What specific requirements did you have when you purchased your computer system?

b. What requirements have you added?

c. What has your system supplier done to meet your new requirements?

4. (a) What application software modules are now part of your system?

(b) What application software modules do you plan to purchase within the next 12 months?

5. What do you see as the key issues facing the dental/medical/hospital/pharmacy business?

6. How do you think computer systems suppliers will meet these issues?

7. (a) What company did you purchase this system from?

(b) What other companies did you evaluate before making the purchase?

8. (a) What companies who sell to other _____ (insert: dentists/doctors/pharmacists/hospitals) do you expect to be market leaders?

(b) Why did you select these firms?

(c) What applications or market areas could a new vendor be successful at serving?

9. (a) Do you plan to move from your in-house turnkey system to an outside processing service in the next 12 months?

____ Yes ____ No

(b) Why? _____

- (c) Do you plan to move to a processing service in the next 12 to 24 months?

____ Yes ____ No

(d) Why? _____

- (e) What features or functions would an outside processing service have to offer you in order to make you switch?

10. Do you use a processing service in your _____?
(insert: practice, organization, ????)

____ Yes (continue) ____ No (terminate)

11. What specific application software modules do you use in this processing service?

12. What other application software modules are available through the service?

13. Which of these other modules do you plan to use in the next 12 months?

14. For what reasons did you select a remote computing service to do your organization's data processing?

15. (a) Did you consider turnkey systems?

____ Yes ____ No

(b) If yes, why was this approach rejected? _____

(c) Did you consider an in-house system?

____ Yes ____ No

(d) If yes, why was this approach rejected? _____

16. (a) Do you plan to move to an in-house turnkey system in the next 12 months?

____ Yes ____ No

(b) Why? _____

(c) Do you plan to move to an in-house turnkey system in the next 12 to 24 months?

____ Yes ____ No

(d) Why? _____

(e) What features or functions would a turnkey system have to offer you in order to make you switch?

17. What issues and needs do you feel are responsible for the changes in processing services?

____ Cost Reduction

____ New Competitors

____ Turnkey Systems

____ New Technology

____ Government Regulations Governing
the Medical Industry

____ Microcomputers

____ Systems Integration

Other: _____

Other: _____

Other: _____

APPENDIX D: VENDOR QUESTIONNAIRE

APPENDIX D

MEDICAL PROCESSING SERVICES/TURNKEY SYSTEMS

VENDOR QUESTIONNAIRE

1. What were your company's sales for the most recent fiscal year?

Sales: _____ million/billion (circle one)

Fiscal Year ends: _____ (specify month)

2. What percent of your company's revenue is derived from the following:

	<u>1985</u>	<u>Projected 1990</u>
Remote Computing Service	_____ %	_____ %
Batch Processing	_____ %	_____ %
Facilities Management Processing	_____ %	_____ %
Turnkey Systems	_____ %	_____ %
Other (Describe) _____	_____ %	_____ %
Other (Describe) _____	_____ %	_____ %
TOTAL	100%	100%

3. The company's largest service is: (Interviewer - complete question based on 1985 percent in question #2 above).

_____ Remote Computing Services (terminate interview)

_____ Batch Processing (terminate interview)

_____ Facilities Management Processing (terminate interview)

_____ Turnkey (Integrated) Systems (Continue Interview)

_____ Other (terminate interview)

[Say: "Please answer the following questions with (either) processing services or turnkey systems in mind."]

4. Would your principal service best be described as:

☐ Industry Specific

What industry/industries do you serve? _____

☐ Cross Industry

What specific function(s) do you specialize in?

☐ Accounting

☐ Education and Training

☐ Engineering/Scientific

☐ Human Resources

☐ Planning and Analysis

☐ Business Graphics

☐ Sales and Marketing

☐ Office Automation

☐ Data Communications

☐ Other _____

5. What do you see as the key market factors affecting the growth of the medical _____ (insert: turnkey or processing services) market?

6. What do you see as the key technological issues affecting the growth of the medical _____ (insert: turnkey or processing services) market?

7. What features (hardware and software) are customers asking for?

8. (a) What specific function(s) within the medical industry (example: patient records, nurses stations, etc.) do you believe are growth prospects for processing services or turnkey systems?

- (b) Why did you select these areas?

9. What do you see as your company's strengths?

10. (a) Who do you see as your main competitors in the market?

- (b) Why did you select these competitors?

Thank You!

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

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